Corps of Engineers Northwestern Division
North Pacific Region
Portland, Oregon

2001

Water Quality Annual Report

Prepared with input from:
Portland District
Seattle District
Walla Walla District
North Pacific Region

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1. Summary

This report on the 2001 Water Quality Program was prepared in conformance with ER 1110-2-8154 and NPDR 1110-2-101. Dredging was also included for reference purposes. The report only covers programs and activities within the North Pacific Region of the Northwestern Division (Portland, Seattle and Walla Walla Districts).

NWD-NP division-wide Water Quality Management Program in 2001 represented an estimated 29 staff-year effort and a combined contracts total of $2.8 million. (See Table 1).

A summary of Division and District activities is given in Table 3, including the three most important issues/concerns and accomplishments in each organization.
The water quality and water quality-related highlights of the year included the following events/activities:

- ✓ Flow augmentation and spill for-fish-passage measures needed to improve fish survival in the Columbia/Snake waterway continued to affect water quantity and quality.
- ✓ The Corps took appropriate actions for attaining a water quality variance from the State of Oregon for the 2001 spill season. A letter was provided to the Oregon Department of Environmental Quality on February 1, 2001. The Oregon Environmental Quality Commission met on March 30, 2001 and approved a variance for the 2001 spill season, subject to specific conditions. Waivers were granted covering part or all of the April 10-August 31 periods, temporarily raising the dissolved gas standards from 110 percent to 120 percent in the tailwater of the spilling dam, and from 110 percent to 115 percent in the forebay of the next downstream dam.
- ✓ The State of Washington modified it's rule on TDG standards for multi-year to accommodate fish passage spill as called from in the NMFS Biological Opinions. The rule is in effect until 2003. Addition actions with the State were not required for the 2001 water year.
- ✓ The State of Idaho was approached in 2000 concerning a variance to water quality standards. The State, in conjunction with the tribes, provided a set of conditions that must be met as part of the variance process. Due to the conditions provided by the State and tribes, the forecasted drought conditions and the foreseen use of Dworshak water releases, there was no further pursuit of a water quality variance by the Corps for the 2001 water year.
- ✓ The Corps opened discussions about the process of pursuing long-term variances from the entitles involved, hoping to eventually replace the year-to-year processes. Meetings with the States and tribes were held in the spring and summer to begin discussions.
- ✓ The Corps's1995 Record of Decision (ROD) and the 1998 Record of consultation and Summary Decision (ROCASOD) adopted the recommendations of the NMFS 1995 BiOp, and the 1998 Supplemental BiOp, respectively.

- ✓ To achieve the objectives of the 2000 BiOp, NMFS developed the jeopardy analysis framework. There are 14 RPAs (namely, RPAs 130 to 143) identified as part of a water quality strategy in the NMFS 2000 BiOp. Specifically, RPA's 131 and 132 deal with water quality monitoring. RPA 131 indicates that the physical and biological monitoring programs are to be developed in consultation with NMFS Forum regional Water Quality Team and the Mid-Columbia Public Utility Districts (PUDs). RPA 132 specifies that a plan must be developed to perform a systematic review and evaluation of the TDG fixed monitoring stations (FMSs) in the forebays of all the mainstem Columbia and Snake River dams.
- ✓ The Districts continued to be responsible for all TDG field monitoring functions. Portland and Seattle Districts contracted out the field calibration and maintenance. Walla Walla District contracted out the routine calibration of the instruments and chose to perform the routine and emergency maintenance with internal staff. The current TDG network included 27 Corps fully automated data collection and transmission facilities installed in forebays and tailwater areas of all Columbia and Snake River mainstem dams and some riverine sites. No unusual data collection and transmission problems were encountered.
- ✓ The US-Canada Transboundary Gas Group (TGG) continued to meet twice a year. This international technical group is designed to cooperatively undertake TDG abatement studies on a systemwide basis. Representatives of NMFS, EPA and the Northwest Power Planning Council are currently the US leads on this effort.
- ✓ Design and/or operational actions associated with the salmon and steelhead recovery effort continued to drive many of the water quality programs in the North Pacific Region.
- ✓ Water quality conditions at most reservoirs and lakes in the Northwestern Division, North Pacific Region remained practically unchanged from the previous years (see Table 4).
- ✓ The Portland District cooperated with resource agencies by monitoring water quality during construction activities at Cougar. This year the construction involved preparing the diversion tunnel for taping, which occurred February of 2002. In spring of 2002 construction of the temperature tower begun. Monitoring involved measuring temperature and turbidity upstream of the project and temperature, turbidity, and DO downstream of the project as well as Hydrolab profiles of the lake at three stations.
- ✓ The Seattle District continued to pursue a dissolved gas abatement study at Chief Joseph Dam in consultation with Washington State and the NMFS regional forum. As called for in the 2000 NMFS Biological Opinion for salmon, the merits of operating Chief Joseph and Grand Coulee Dams jointly for dissolved gas abatement were examined in a system wide study.
- ✓ The Walla Walla District installed concrete end bay deflectors at McNary Dam and is planned for at Lower Monumental and Little Goose Dams.
- ✓ The Walla Walla District and the Dworshak National Fish Hatchery water systems are operating under voluntary consent orders with the State of Idaho. Corrective actions to bring these systems up to Safe Drinking Water Standards are scheduled for December 2003 and 2002.

Listed below for the Division and the three Districts are more specific water quality highlights for 2001.

1.1. North Pacific Regional Office

- ✓ Day-to-day coordination of the basinwide TDG monitoring program in the Columbia River Basin.

- ✓ Pursue actions needed from the State of Idaho, Oregon, and Washington to obtain a yearly variance, as well as a long-term variance.

- ✓ Implement relevant sections of the 2000 BiOp regarding operations that impact Water Quality and Environmental issues.

- ✓ Participation in the activities of the Technical Management Team (TMT), a regional inter-agency group to advise on the weekly reservoir operation for the salmon recovery in the Columbia River Basin.

- ✓ Winter monitoring of TDG continued for the fourth year at selected lower Columbia/lower Snake River projects.

- ✓ Water quality staff operated and maintained an Internet homepage that provides the real-time project information needed for basin-wide water management.

- ✓ Active contribution to the preparation of the following annual planning documents: (1) 2001 Water Management Plan for the Columbia and Snake River system, for use by the TMT, (2) 2001 TDG Management Plan (for attachment to the TMT's Water Management Plan) and (3) Plan of Action for the 2001 TDG monitoring.

- ✓ Refinement and application of statistical procedures for predicting dissolved gas saturation levels, including evaluation of the increase in TDG mass caused by spill up to the 120% TDG target.

Continued active participation in other regional forums dealing with water quality, including coordination of TDG-related regional research plan in NMFS's Dissolved Gas Team, the Clean Water Action Plan group, and coordination with EPA, the states and tribes in the development of mainstem TMDLs.

1.2. Portland District

- ✓ Completion of the sixth year of successful assumption of direct responsibility for dissolved gas monitoring at 8 stations on the lower Columbia River starting from John Day forebay, using the services of the USGS. Data loss for WY 2001 was less than 1 percent.

- ✓ Completion of a summary water quality report for the Willamette Projects: Hills Creek, Lookout Point, Dexter, Fall Creek, Dorena, Cottage Grove, and Fern Ridge that encompassed water quality since the projects became operational.

- ✓ Participation in a cooperative effort with the U. S. Forest Service/ City of Salem concerning turbidity studies in the upper Santiam River watershed.

- ✓ Water continued to be released from Lost Creek and Applegate to improve Spring Chinook and Fall Chinook salmon spawning conditions. Flow and water temperature targets were again met. Routine water quality monitoring for nutrients and limnological parameters continued at both projects.

- ✓ In the Willamette River Basin turbidity was measured at Detroit Lake outflows in cooperation with a watershed monitoring program involving the USFWS, COE, USGS and the City of Salem.

- ✓ As part of the PAS program (Planning Assistance to the States) water temperatures were monitored at 10 locations – 3 above Green Peter, one below Hills Creek, one each above Lookout Point, Dorena and Cottage Grove, and three in the Mckenzie River – all to assist the state in it's modeling effort regarding a temperature TMDL.

- ✓ The selective withdrawal structure at Willow Creek Lake was again used to aid locals in improving downstream water temperatures.

Continuous findings of no contamination in dredged material samples collected from selected NWP's project sites.

1.3. Seattle District

- ✓ The District continued to be an active participant in the Instream Flow Commission, a multi-agency commission to establish flows for the Cedar River, a tributary to Lake Washington.

- ✓ The District continued to monitor water temperature at Wynoochee Dam, owned by the City of Aberdeen and operated by Tacoma Public Works Department.

- ✓ The District continued to study the effect of increased conservation storage at Howard A. Hanson Dam. The installation of the environmental mitigation has been completed.

- ✓ TDG was monitored at the two permanent water quality sites (forebay and tailwater) at Chief Joseph Dam.

- ✓ The District continued to monitor water quality throughout the ship canal (5 permanent water quality stations), Lake Koocanusa and the Kootenai River via a

contract with USGS (6 permanent water quality stations) and at Howard Hanson dam (8 sampling sites).

- ✓ A two-dimensional water quality model was used to simulate saltwater intrusion into the Lake Washington Ship Canal.

The District continued to participate in the numerous fish studies through out the Green and Cedar River basins to improve the water quality and habitat of salmonids.

1.4. Walla Walla District

- ✓ The Walla Walla District constructed and placed six (prototype mark I) multiple level thermister buoys in the McNary Dam forebay area. Water Year 01 was an abnormally dry year. Subsequently some action agencies called for a "temperature emergency" because of potential for fish kill at collection facilities, particularly this was feared to arise at the McNary facility. Therefore, this year's primary focus for operational for water quality pertained to potential juvenile salmon mortalities at McNary and Lower Snake River collection facilities. Another study reviewed temperature differences in fish collection channels. The USGS used experimental flow inducers to try and reduce thermal gradients in anticipation of the severe low flow conditions of last year and studied the potential benefits that could be derived from redirecting deeper and cooler water into the passage systems.

- ✓ Temperature measurements were made in the Dworshak Reservoir using cheap stowaway temperature loggers. At eight different locations there were point thermisters and the chains collected yearly temperature data. This data is only used as qualitative data because the cheap disposable units used fail quality control standards for accurate data collection. The study information is to be used by the water quality staff to advise operations when operating for temperature and to select additional locations for temperature monitoring as needed.

- ✓ New Total Dissolved Gas (TDG) sonde deployment systems were installed at Ice Harbor and Lower Monumental tail water stations. TDG monitoring was conducted at 16 project stations. Data was transmitted to the CROHMS database.

- ✓ Improvements in sampling and systems operations of water and wastewater were attained at Little Goose and Lower Granite Dams. Letters were drafted for new National Pollution Discharge Elimination System Permits. Sampling and testing was performed according to state and federal guidelines.

- ✓ Work was begun and an outline drafted for a District Dredge Evaluation Framework. Sediment sampling was conducted at Corps properties at Wallulla Junction adjacent to McNary National Wildlife Refuge and Lindsay Creek Diversion area in Lewiston. Sediments were analyzed for a variety of organic and inorganic constituents. Recommendations were made on sediment disposal.

- ✓ The McNary Project, at Hood Park; Washington Department of Health notified the Corps that Well #1 is not a permitted well and shall not be operated as a public water supply until approval.

- ✓ The nine district swim beaches are monitored for fecal coliform bacteria.

1.5. Staffing

Division-wide staffing as shown in Table 1.a.

Table 1.a. 2001 Water Quality Staff Levels
(includes staff in water quality-related disciplines)

Offices	GS-7/8	GS-9	GS-11	GS-12	GS-13	Total
Division Water Mgt			1	1	1	3
Portland EC			2			2
Seattle Water Mgt	1	1	2		1	5
Seattle ERS		1	2	7	1	11
Seattle DMO				2	1	3
Seattle RGS					1	1
Seattle NS				1		1
Walla Walla EN			2			2
Walla Walla OP				0.2		0.2

Water quality staff expertises are shown in Table 1.b.

Table 1.b. Water Quality Staff Expertise (2001)

Staff	Technical Expertise	Years in WQ	GS-Grade
Regional Office			
CENWD-CM-WR-N			
Richard Cassidy	Reservoir regulation, limnology, hydrology	32(32)	13
Nancy Yun	Database, modeling, data analysis	17(11)	12
Ruth Abney	Environmental chemistry, computer specialist	12(0.5)	11
Portland District			
Roger Ross		35(1)	13
Jim Britton	Sediment quality, water quality, biology, toxicology	33(14)	11
Mark Siipola	Civil engineer, oceanography	25(16)	12

Mike Posovich	Environmental engineer, water quality modeling	8	11
Tim Sherman	Biology, chemistry	23(12)	11
Laura Hamilton	Environmental engineer, data management	19(6)	11
Kathryn Harris	Environmental engineer	5	11
Seattle District			
EC-TB-HH-WM			
Wayne Wagner	Oversight of District WQ Program		13
Marian Valentine	hydrologic engineering, WQ studies, chemistry, limnology	6	13
Louie Read	instrumentation, field work	12	8
Ray Strode	instrumentation, field work, data collection platform installation	19	11
Layna Goodman	Project management , hydrogeology	6	9
Walla Walla District			
CENWW-ED-H			
Dave Reese	Oversight of District WQ Program		
Russ Heaton	limnology, water quality, aquatic ecology, water chemistry, invertebrate and microbiology, dissolved gas sampling and analysis, sediment chemistry, hazardous materials, parisitology, toxicology, dredge material testing, and lab management	12	11
Phillip Fishella	limnology, sediment and water sampling, aquatic plants, water and wastewater treatment, fisheries management, fish culture, wildlife management, wetlands ecology.	20 (18)	11
CENWW-OD-RM			
Jimmie Brown	Environmental compliance, potable and swim beach water quality monitoring, ERGO	26 (9)	12

1.6. Contracts

District water quality contracts are summarized in Table 2.

Table 2. 2001 Water Quality Contracts Summary (in $1,000s)

Offices	Universities and AE's	Other Corps	Other Federal	Water Quality	Sediment Quality	Total WQ+SQ
NWD-NP						
NWP	845.7	7.0	455.9	738.3	569.9	1308.2
NWS			120.0	1102.4	31.5	1133.9
NWW	260.0	0	0	12.0	0	272.0
TOTAL	1005.7	7.0	575.9	1852.7	600.4	2714.1

1.7. Activities

Annual water quality activities are summarized in Table 3.

Table 3. 2001 Annual Water Quality Activity Summary

Items	NWD-NP	NWP	NWS	NWW
A. No. of WQ Monitoring Stations				
A1. Reservoir	-	16	15	-
A2. Riverine.	-	40	35	-
A3. Dredging	-	1350	8	-
A4. Others. .	-	-	6	-
B. No. of WQ Studies related to:				
B1. Planning	1	8	18	-
B2. Operations	1	11	6	5
B3. R&D	1	1	9	-
B4. Others	-		-	-
C. No. of WQ reports				
C1. In-progress	0	2	-	3
C2. Completed	4	12	8	-
D. WQ Staff and Contract Amount				
D1. FTE's ..	3	9	21	2
D2. Full-time staff.	2	9	6	2
D3. Part-time staff.	0	0	15	1
D4. Contract Amount ($1,000)	0	845.7		272
E. Support Rec'd (+) or Given (-)				
E1. HEC/WES	+1	+2	+1-1	+2
E2. Other districts.	0	0	+3-3	+8
E3. Others (AE,U)	+0	+24	+3-2	+13

1.8. Summary of Water Quality Conditions

Three most important issues & accomplishments are shown in table 4.a.

Table 4.a. Issues/Concerns & Accomplishments

Three Most Important Issues/Concerns	Three Most Important Accomplishments
NWD-NP 1.Dissolved gas supersaturation 2.Water Temperature 3.Regional coordination for the NMFS forum and TMDLs.	NWD-NP. 1. TDG: Coordination & Applications 2. Activities within TMT and DGT Teams 3. Coordination of NWD-NP-WQ programs
NWP 1. TDG in Lower Columbia River Projects 2. TDG and T ^{0} TMDLs in Willamette & L. Columbia River 3. Columbia and Willamette River BiOPs – RPAs and Water Quality Plan	NWP 1.Successful TDG fixed monitoring program 2. Selective withdrawal at Willow Creek to lower downstream temperatures 3. Installment 2 of Willamette Valley Project water quality report 4. PAS support to Oregon for TMDL development
NWS 1.Disposal of dredged material 2. Saltwater intrusion Lake Union 3.Water Temperature	NWS 1.Chief Joseph Gas Abatement 2.Improvements to dredged analysis info system 3.Improved real-time regulation for WQ
NWW 1. Public Health 2. Impacts of proposed dam breaching, dredging 3. High temperatures in Lower Snake and McNary	NWW 1. Increased support to water and wastewater problems 2. Feasibility and Dredged Material Management Draft EIS section Reports 3. Installation of fish facility temperature monitors. Multi level temperature thermister units designed and installed at McNary forebay. Dworshak temperature study

A summary of Northwestern Division water quality conditions is shown in Table 4.b.

Table 4.b. Summary of 2001 Water Quality Conditions

Districts/Projects	Ratings	Historical Problems	2001 Problems	Future Problems
Portland				
1. Lost Creek	Good	Outflow temperature	Outflow temperature, algae bloom	Outflow temperature.
2. Applegate	Good	Outflow temperature, mercury	Outflow temperature, algae bloom	Outflow temperature, mercury, anoxia
3. Fall Creek	Good	H_2S, algae, anoxia	Outflow temperature	Algae, Temp.
4. Hills Creek	Fair	Turbidity, algae, outflow temperature	Outflow temperature	Turbidity, algae
5. Lookout Pt.	Good	None	TDG, Outflow temperature	TDG, temp
6. Dexter	Fair	Algae, macrophytes	TDG, Outflow temperature	TDG, temp
7. Dorena	Fair	Mercury	Mercury, anoxia	Mercury, anoxia
8. Cottage Gr.	Fair	Mercury	Mercury, anoxia, temp	Mercury, anoxia, temp
9. Fern Ridge	Poor	Eutrophication, nuisance aquatic plants	Nutrients, nuisance aquatic plants	Eutrophication, Aquatic plants
10.Willow Cr.	Poor	Enrichment	Anoxia, H_2S, nutrients, methane, algae, fecals	Anoxia, H_2S, nutrients, methane, algae, fecals
11.Cougar	Good	Temperature	Outflow temperature	Temp.,algae
12.Blue River	Good	Temperature	Outflow temperature	Temp., algae
13.Detroit	Good	Temperature, turbidity	Turbidity, outflow temperature	Turbidity, outflow temperature
14.Big Cliff	Good	Temperature, turbidity	Turbidity, Outflow temperature	Turbidity, outflow temperature
15.Green Peter	Good	Turbidity, temperature	Outflow temperature	Turbidity, outflow temperature
16.Foster	Good	Turbidity, temperature	Outflow temperature	Turbidity, outflow temperature
17.Bonneville	Good	Dissolved gas, temperature	TDG>110%	TDG, temperature, nutrients
18.The Dalles	Good	Dissolved gas,	TDG>110%	TDG, temperature,

		temperature		nutrients
19.John Day	Good	Dissolved gas, temperature	TDG>110%	TDG, temperature, nutrients
Seattle				
1. Libby Dam	Good	Nutrient, metals, temp.	None	None
2. Albeni Falls	Good	No temp controls, metals	Outfall Temp	Temp
3. Chief Joseph	Good	No temp controls	None	Temp, TDG
4. Mud Mountain	Good	Turbidity, sediments	None	Turbidity
5. Howard Hanson	Exc	No temp controls, turbidity	None	Turbidity
6. Nav Locks &	Fair	Saltwater intrusion,	Saltwater intrusion	Benthic O_2 Demand
Lake Union		toxic + metals waste, sediment O_2 demand	SOD	Toxic organics
7. Wynoochee	Exc	Outflow temperature	Outfall Temp	Outfall Temp
Walla Walla				
1. Dworshak	Good	Trash/Debris, TDG, Turbidity, potable water	Potable water operating under MOU with State of Idaho. Separate MOU for Dworshak National Fish hatchery. Currently looking at participation in local water district.	Increase withdraw and drawdown, Decreased fish productivity
2. Lower Granite	Fair	High levels of Total Dissolved Gas during high flow periods. In the summer high water temperatures, increase nutrient loading, and slower water velocities contribute to blue-green algae blooms.	Have No NPDES permits for Fish facility outflow. Systems need to be operated and maintained on a daily basis. System equipment operations needs to be formatted	Contaminated Sediments impacting dredging operations and contributing to eutrophication conditions during low flow periods. Increased pesticides and herbicides in the runoff. Many of the newer pesticides and herbicides have not

				been tested for their deleterious effects
3. Little Goose	Fair	High levels of Total Dissolved Gas during high flow periods.	Have No NPDES permits for Fish facility outflow. Systems need to be operated and maintained on a daily basis. Effluent sample needs to be a composite to be more representative	Contaminated Sediments impacting dredging operations and contributing to eutrophication conditions during low flow periods. Increased pesticides and herbicides in the runoff. Many of the newer pesticides and herbicides have not been tested for their deleterious effects
4. Lower Monumental	Fair	High levels of Total Dissolved Gas during high flow periods.		Contaminated Sediments impacting dredging operations and contributing to eutrophication conditions during low flow periods
5. Ice Harbor	Fair	The potable water has been a problem at Ice Harbor for several years. Fecal coliform at swims beaches and in water supplies have been historical problems. High levels of Total Dissolved Gas during high flow periods.	Problems with potable water exceeding nitrates. Problems with potable water exceeding coliform level. Problem getting all required testing done. Problems posting of water system. Well #3 not approved by Washington Dept of Health for potable water.	High Temperatures. Increase in water disposal, algae, delayed fish passage, bacteria, shoaling problems with well #1 in Hood Park. Not approved for potable water by Washington Dept of Health. Non- point source nutrient loading. Increased pesticides and herbicides in the runoff. Many of the newer pesticides and herbicides have not been tested for their

				deleterious effects
6. McNary	Fair	Dissolved Gas, temperature	Problems with well #1 in Hood Park. Not approved for potable water by Washington Dept of Health. High dissolved gas and water temperatures were a problem	Temperature. Non-point source nutrient loading. Increased use of pesticides and herbicides. Unknown concentrations in the runoff Present a challenge to making factual determinations
7. Lucky Peak	Good	None	Swimmer's itch	Increase demand, non-point source nutrient loading
8. Mill Creek	Fair	Stratification, anoxia, turbidity, swimmer's itch	Sedimentation due to flooding	High Turbidity, Conditions caused by reservoir refill

2. Water Quality Management Program

2.1. Introduction

This portion of the report summarizes the Northwestern Division (North Pacific Region) Water Quality Management Program for program objectives, major activities, accomplishments in 2001, and proposed objectives for 2002. The report conforms to ER 1110-2-8154, Water Quality and Environmental Management for Corps Civil Works Projects dated 31 January 1995, and with NPDR 1110-2-101, Water Control Management - Quality, dated 19 December 1986.

2.2. Organization And Coordination

Most NWD-NP Reservoir Control Center water quality programs are surveillance and monitoring in nature. These programs are to ensure that Corps activities meet all applicable federal, state and local standards to the full extent possible. In some cases, water quality programs can be project-specific and lead to changes in project operations and/or design features. An example is dissolved gas monitoring and its use in adjusting real-time spill on the mainstem Columbia and Snake Rivers or longer term efforts of changing spill patterns and modifying spillway and stilling basin configurations. Data from the dissolved gas monitoring program is also being used to help refine existing regression-based and deterministic dissolved gas models.

In many districts, compliance with the Clean Water Act (e.g. NPDES — National Pollutant Discharge Elimination System, and Section 404(b)(1) evaluations) is managed under the water quality program. Although most division and district water quality

elements have no direct regulatory responsibility, their annual reporting requirements are more extensive than those of other functional elements.

2.2.1. Assigned Responsibilities

2.2.1.1. Regional Office

At the regional level, the Water Quality Team (WQT) in the Reservoir Control Center (Water Management Division, Engineering and Technical Services Directorate) provides technical and policy guidance on CENWD-NP's water quality programs. The WQT is responsible for monitoring the TDG and water temperature conditions in the forebays and the tailwaters of the lower Columbia River/ lower Snake River dams, and selected river sites. The operational water management guidelines are to change spill levels and subsequently, spill patterns at the dams (daily if necessary) so that the forebays are close to, but do not exceed State Water Quality Standards. This team also addressed variances from the total dissolved gas water quality standard with the appropriate States and tribes impacted by the program implemented in the Federal Columbia River Power System (FCRPS) for which the Corps has responsibility. As a long-term strategy, the Corps opened discussions about the process of pursuing long-term variances from the entities involved, hoping to eventually replace the year-to-year processes.

Coordination also extends to other water quality programs and activities by the Corps, other agencies and regional organizations.

- ✓ The WQT staff directly coordinates and schedule short- and long-term reservoir operations for water quality that impact fish passage and fishery research.

- ✓ The WQT prepares a dissolved gas Plan of Action each year. It is a supporting document for the NMFS Forum Technical Management Team, which makes recommendations on the operation of the Federal Columbia River Power System for multi-purpose use. The Plan stipulates what to measure, how, where, and when to take the measurements and how to analyze and interpret the resulting data. The Plan also provides for periodic review and alteration or reduction of efforts when monitoring results and/or new information from other sources justifies a change.

- ✓ The WQT represents the Corps as active participants in the NMFS BiOp Water Quality Team, which is expanding to address regional TMDL issues.

- ✓ The WQT is responsible for preparing an annual TDG Annual Report for distribution to the region, after review and synthesis of materials submitted by the districts.

2.2.1.2. Districts

At the district level, all three NWD-NP districts are assigned broad responsibilities in developing and implementing water quality management programs. Districts are responsible for identifying and monitoring the sources of water quality problems

affecting (or caused by) their projects. They inform State and Federal agencies of water quality changes that could present a public health hazard. They report emergency events to the Division's Readiness Management (Operations, Construction & Readiness Directorate). Some of their water quality activities overlap with other programs, such as the Defense Environmental Restoration Program and EPA Superfund Program. Water quality problems that can be resolved through reservoir operations are reported to the Reservoir Control Center for appropriate actions.

Primary responsibility for reservoir water quality programs usually rests with the planning and engineering elements. This is true for the Portland and Seattle Districts. In CENWW (Walla Walla District), the Engineering H&H Branch and Operations Division's Natural Resources Management manages water quality. The H&H Branch also handles hazardous, toxic, and radioactive waste (HTRW) issues including ground water and sediment contamination with emphasis on contaminant identification It provides water quality expertise and coordination for planning studies such as the Dissolved Gas Monitoring, Lower Granite Dredging Compliance Monitoring, Lower Snake River Project Water and Wastewater operation, and Public Health activities. The District Water Quality steering committee coordinates work with other districts and division as needed.

All NWD-NP districts have direct access to the Waterways Experiment Station in Vicksburg, MS and the Hydrologic Engineering Center in Davis, CA for physical and mathematical modeling support. Each district reports its water quality activities annually to the Regional Office for review, synthesis, reporting and posting on the Internet.

2.2.2. Cooperation with Other Agencies

District and Division staffs routinely coordinate with Federal, State, and local agency environmental quality counterparts and state Department of Health for Public Services. The listing of twelve Pacific salmon species under the Endangered Species Act (ESA) has made this coordination critical since the Corps is responsible for the operation of it's project for multiple purposes. All water users have a vested interest in what operation is being planned by the Corps, where, when, and how.

CENWD-NP's Reservoir Control Center (RCC), in the Water Management Division, plays an active role in implementing the flows measures contained in the NMFS's 2000 Biological Opinion. There is continual dialogue between RCC and the Pacific Salmon Coordination Office, the Bonneville Power Administration (BPA), utilities, state and federal fishery agencies and Indian Tribes. The RCC makes all final reservoir regulation decisions, frequently based on recommendations from the Technical Management Team, a mid-management level group set up by NMFS in 1995 and chaired by the Corps representative.

NWW cooperates with the U.S. Department of Energy in analysis of existing data, development of GIS, and plans for future activities in water quality and fishery programs. Studies of sediment pollution for dredging activities are performed in cooperation with EPA and the Washington Department of Ecology. State of Washington Department of

Ecology, State of Idaho Division of Environmental Quality (IDEQ), NMFS, and ODEQ in performing NPDES permitting activities. Contacts with IDEQ, State of Washington Department of Ecology, EPA, and U.S. Department of Energy are also needed to help address sediment transport and contaminant concerns

2.2.3. National Corps Committees

CENWD-NP is represented on national Corps committees. These include the Corps' Committee on Water Quality (by CENWD-CM-WR-N), Committee on Tidal Hydraulics (by CENWS's Engineering), Corps Research and Development Field Review Group (by CENWD-CM-WR-N and CENWP-NP-ET-HR), and Committee on Hydrology (by CENWD-NP-ET-WH).

2.3. Major Goals And Objectives

Executive Order 12088, dated 8 November 1978 made it a national policy for the Federal Government to provide leadership in a nation-wide effort to protect and enhance the quality of air, water, and land resources. ER 1110-2-8154 (Water Quality and Environmental Management for Corps Civil Works Projects) dated 31 May 1995 establishes a policy for the water quality management program at Corps civil works projects. In accordance with this policy and additional guidance provided in NPDR 1110-2-101 ("Water Control Management, Water Quality") dated 19 December 1986, the established long-term goal of the Division's Water Quality program is to ensure that waters at each project are of suitable quality for the project's established project use(s). To meet this goal, there is a need to:

- ✓ Develop a good understanding of the physical processes affecting water quality, including relationship between project operations and ambient water quality conditions; and

- ✓ Monitor water quality trends and current conditions so that future conditions can be reliably predicted and efficient corrective actions taken.

In order to achieve these objectives, there is a need to:

- ✓ Maintain staff capability in state-of-the-art water quality techniques and procedures, and correct application thereof;

- ✓ Implement reliable and adequate monitoring programs to support water management functions in an efficient and expeditious manner;

- ✓ Provide a comprehensive, up-to-date, and easily accessible data base; and

- ✓ Foster close cooperation with other Federal, State, and local agencies involved in water quality programs.

Objectives set by each district reflect the district's own priorities and requirements. These objectives and a summary of their status for FY01 are listed in the following sections.

2.3.1. Regional Office

2.3.1.1. Objectives

1. Continue to coordinate and monitor the Corps annual total dissolved gas monitoring program in the Columbia River Basin;

2. Continue to monitor and adjust spill levels at Corps projects in the Columbia River Basin during the spill season to maintain levels below the state standards for TDG (115% in the forebays and 120% in the tailraces) and temperature (68F);
3. Continue to improve numerical modeling capability;

4. Continue to improve Division-District coordination on water quality and related issues;

5. Continue to provide water quality and general environmental support to others as needed.

2.3.1.2. New Objectives

1. Work with States to resolve state water quality variance issues.

2. Develop an inter-agency Water Quality Plan for the Columbia/Snake system.

3. Participate in the development of a CENWD – North Pacific Water Quality Team to provide regional program management guidance.

4. Develop and implement 1-year and 5-year Water Quality Plans as specified in the 2000 NMFS BiOp.

5. To achieve the objectives of the 2000 BiOp, NMFS developed the jeopardy analysis framework. There are 14 RPAs (namely, RPAs 130 to 143) identified as part of a water quality strategy in the NMFS 2000 BiOp

2.3.1.3. Status

Objective 1 (dissolved gas monitoring), represents a continuing effort started in 1984. The Corps total dissolved gas and water temperature monitoring now includes deployment of 27 fully automated instruments at both forebay and tailwater areas of all Corps mainstem dams and other river locations. Division staff continues to coordinate the monitoring program on a system-wide basis, prepare real-time data reports, disseminate relevant information, and store the information in a permanent database.

Objective 2 (monitor and adjust spill levels), information collected through the dissolved gas monitoring program was used by the Inter-agency Technical Management Team on a

real-time basis for adjusting project spill in an attempt to control total dissolved gas levels to the State standards. A spill and dissolved gas management policy was formulated and implemented annually division-wide. As was the case in the previous five years, NMFS required that spill be implemented at lower Columbia and lower Snake Rivers mainstem dams to improve juvenile passage conditions.

Objective 3 (develop, maintain and operate an active homepage), project operational information including fixed monitoring station data (TDG and temperature) are published real time from CROHMS on the TMT web page to aid regional decision makers. Monthly historical summaries of the FMS data are also published on the TMT web page.

Objective 4 (development of TMDL), active participation in regional forums dealing with water quality issues with EPA, the states and tribes in the development of mainstem TMDLs.

Objective 5 (coordination with Districts); institutionally a continuing activity. Division staff closely coordinated with all three Districts in many areas, including TDG monitoring scheduling special reservoir operation s for TDG-related research.

2.3.2. Portland District

2.3.2.1. Water Quality Objectives

1. Continue limnological and routine water quality monitoring at Lost Creek and Applegate Lakes, Rogue River Basin, Oregon; and at Willow Creek Lake, Heppner, Oregon.

2. Continue to operate and maintain stream-gaging programs in the Willamette and Rogue River Basins, Oregon, Willow Creek basin, and in Toutle River basin, Washington, and in the Lower Columbia River main stem.

3. Work with Oregon resource agencies to develop instream-flow rules for the Willamette River requiring the Corps of Engineers to provide specific flows year-round for fisheries and water quality enhancement.

4. Continue coordination with resource agencies to assure Portland District's compliance with Federal and State water quality regulations at existing and proposed Federal projects.

5. Continue studies of mercury contamination in Cottage Grove and Dorena Reservoirs.

6. Continue selective withdrawal at Willow Creek Reservoir to aid locals in reducing temperatures in Willow Creek and so that the immediate downstream portion can be removed from the State’s 303(d) list.

7. Review historic and current data to determine problem specific water quality studies to conduct at Corps projects.

8. Continue to implement the District Fixed Monitoring Program (FMP) for monitoring TDG below Corps Projects in the lower Columbia River. Evaluate the need for dropping and/or moving FMP sites to improve the program.

9. Continue to monitor TDG below Corps Projects in the Willamette and Rogue Basin on an as-needed basis.

10. Continue to participate with the U.S.F.S. and the city of Salem as a team member to monitor water quality in the North Santiam Watershed.
11. Implement plans and specifications for water quality monitoring during construction of the Selective Withdrawal Tower at Cougar Reservoir.

12. Continue to support efforts to set up water quality models of District Projects that have important water quality problems.

13. Support the State and EPA in developing TMDLs for the Willamette and Columbia River.

14. Participate in developing a water quality plan for District projects in the Lower Columbia River as required in the NMFS Biological Opinion on saving threatened fish species.

2.3.2.2. New Goals for 2001

1. Make plans for new water quality monitoring effort at Lost Creek, Applegate, and Willow Creak projects coordinating with on-site resource personnel.

2. Deploy temperature loggers above Green Peter, Lookout Point, Cottage Grove, Dorena, and below Hills Creek to collect data to assist the DEQ in its Willamette River modeling effort for developing a temperature TMDL.

2.3.2.3. Water Quality Status

Objective 1 (Mercury budget at Cottage Grove) was put on hold because of draught year conditions.

Objective 2 (Water modeling) A cost estimate for developing water quality models (CE-QUAl-W2) at Detroit, Green Peter, Cougar, Lookout Point and Hills Creek projects was worked-up.

Objective 3 (TMDL support) Support was provided to Oregon through the Planning Assistance to States program (PAS) for modeling the Willamette River for temperature. Help was also given to Oregon and Washington in developing the Total Dissolved Gas (TDG) TMDL for the lower Columbia River projects – Bonneville, The Dalles, John Day.

Objective 4 (Columbia River BiOP water quality plan) Work continued with other Action Agencies in developing a water quality plan for fulfilling requirements of the ESA.

2.3.2.4. Sediment Quality Objectives

1. Implement plans and specifications for water quality monitoring during construction of the Selective Withdrawal Tower at Cougar Reservoir.

2. Continue the District-wide sediment quality evaluation program at Operations and Maintenance dredging projects. During FY 2001, sediment quality evaluations will be conducted in the Columbia River, Lower Willamette River, Umpqua River, Coquille River, Siuslaw and Chetco River federal projects.

3. Continue coordination with resource agencies to assure Portland District's compliance with Federal and State water quality regulations at existing and proposed Federal navigation projects.

4. Additionally, advise the Regulatory and Environmental Resource Branch (CENWP-EC-R) on testing procedures and interpretation of results for Section 404/103 permit actions.

5. Continue to develop management/monitoring plans and implement the management/monitoring programs for ODMDSs.

6. Continue to participate in development of regional dredging teams as defined in the December 1994 MARAD report.

7. Continue to implementation of the Columbia River Regional Testing Manual for sediment quality evaluation.

2.3.2.5. New Goals for 2001

1. Continue development of SEDQUAL database.

2. Complete ODMDS evaluation study and Section 103 selection for new 2 new ODMDS at Yaquina Bay.

2.3.2.6. Sediment Quality Status

Objectives 1 (sediment quality evaluations), 2 (standard compliance), and 3 (ODMDS studies) were fully achieved in FY 2001. More work will be done still in FY 2002.

Objectives 2 (management and monitoring of ODMDS programs), annual bathymetric surveys were completed at the ODMDSs. Mathematical models of dredged material placement and subsequent sediment transport were conducted at MCR and ODMDSs E.

Objectives 3 (participation in regional dredging teams) are an on-going activity. A team consisting of Corps, EPA, NMFS, USFWS, ODEQ, WDOE and WDNR representatives is charged with updating (DMEF) guidelines for regional dredging activities.

Objectives 4 (SEDQUAL) is an ongoing effort.

Objectives 5 (Yaquina Bay ODMDS evaluation) was completed.

2.3.3. Seattle District

2.3.3.1.Water Quality Objectives and Goals

1. Continue performing project and related data evaluation and reduction.

2. Continue development and application of an operational water temperature model for Libby Dam to aid in determining the effects of Kootenai River white sturgeon flows (as required by the Endangered Species Act).

3. Continue to develop and implement a total dissolved gas-monitoring program for Libby Dam and the Kootenai River in the event of spill.

4. Continue automating data collection capabilities with emphasis on the Lake Washington Ship Canal.

5. Continue maintenance and updates to the Dredged Analysis Information System (DAIS).

6. Continue coordination with other federal, state, and local agencies involved in water quality programs, on all project planning, construction and operating efforts.

7. Insure that water quality assessment and water quality goals are included in watershed evaluations conducted by the District.

8. Continue development and application of a predictive model of salinity intrusion for the Lake Washington Ship Canal (LWSC).

9. Continue to develop a sediment-monitoring program at Howard Hanson Dam (HDD) as part of the drawdown of the turbidity pool.

10. Continue interagency discussion to develop solutions to dissolved gas problems above and below Chief Joseph Dam.

Continue to evaluate the possibility of installing at least one new generating unit at Libby Dam to allow high flows with reduced risk of spill and high TDG levels.

2.3.3.2.Water Quality Status

All objectives were adequately met during 2001.

Objective 1 (data evaluation). Efforts were made to continually re-evaluate and enhance the District's water control data collection system. A cooperative data collection program was continued with the U.S. Geological Survey. Summaries of fish ladder operations and gate settings at the LWSC were provided to the state for water quality comparisons.

Objective 2 (Libby water temperature monitoring) continued in 2001. The District successfully used a numerical model to assist a multi-agency recovery team in planning Libby Dam releases that would benefit sturgeon larval releases from the Kootenai Indian Tribe's fish hatchery.

Objective 3 (TDG monitoring below Libby). The District maintained readiness to operate a total dissolved gas sensor at the gage house downstream of Libby Dam in the event of spill. In the rare event of spill for flood control, District personnel plan to monitor dissolved gas between Libby Dam and the Kootenai Falls. Spill for flood control operations have not been necessary for over a decade.

Objective 4 (Data collection on Lake Washington). The District continued operation of six water quality stations in the Lake Washington Ship Canal (LWSC). All stations transmit real-time data to the District's Reservoir Control Center. The LWSC data are used to make operational decisions for control of saltwater intrusion.

Objective 5 (Dredge Analysis). The Dredged Analysis Information System (DAIS) continued to be used successfully to manage data used in the assessment of sediment quality for regulated and federal operations and maintenance projects.

Objective 6 (Coordination with others). The District conducted meetings with the Department of Interior, interagency meetings on Chief Joseph dissolved gas abatement problem, the installation of additional generating units at Libby Dam and meetings with State and local governments. ERS coordinated with State and Federal agencies and Tribes for water quality certification, hydraulic permits and environmental studies related to water quality.

ERS began projects as part of Planning Assistance to the States programs including:

(1) A habitat assessment and juvenile salmonid utilization of intertidal and supralittoral zones in King County.
(2) Spokane River water quality assessment.
(3) A Snohomish River estuary salmonid study.

Objective 7 (Incorporation of water quality goals). Environmental Resources Section incorporated water quality goals into the study design of three continuing general investigation studies on the Stillaguamish, Duwamish/Green Basins and at Howard Hanson Dam on the Green River. The focus of these projects is on fish and wildlife

restoration. ERS incorporated sediment and water quality goals and sampling into the design and/or construction of 7 Section 1135 habitat restoration projects:

1. Lake Washington Ship Canal
2. Bear Creek
3. Sammamish Weir
4. Turning Basin.
5. Wynoochee Dam
6. Howard Hanson
7. Old Stillaguamish Channel

Objective 8 (Salinity Model). The Hydrology and Hydraulics Section continued refinement of a predictive model of saltwater intrusion for the Lake Washington Ship Canal. The model is currently being used to predict the movements of the saltwater wedge as a result of changing operations at the Locks.

Objective 9 (Sediment monitoring at HHD). The Hydrology and Hydraulics Section monitored total suspended solids on the Green River above Howard Hanson Dam to determine if there is a correlation with between turbidity and total suspended solids. This effort will continue in WY 2002.

Objective 10 (TDG issues at Chief Joseph Dam). The District continues to participate in interagency discussion to develop solutions to dissolved gas problems above and below Chief Joseph Dam.

Objective 11 (New Turbine Unit at Libby). The District provided information to outside agencies that are exploring power unit installation as a means of reducing the risk of spill and high TDG levels at Libby Dam.

2.3.4. Walla Walla District

2.3.4.1.Water Quality Goals and Objectives

1. Develop a district potable water program that encompasses procedures and contacts for all operation and emergency situations. The program will include training systems and test / evaluation programs. A final work product of this effort will be to document the outline of this program. This was a joint effort between H&H Branch and Natural Resources Branch.

2. Develop a district sanitary system program similar to program in objective number one. This was a joint effort between H&H Branch and Natural Resources Branch.

3. Identify existing facilities that need coverage under the Clean Water Act (CWA) and the Safe Drinking Water Act (SDWA) and compliance status. Plan for corrective actions and develop budgets specifically to correct the problems. Also determine necessary permits and operations to comply with Phase II NPDES and WRDA 96.

4. Identify personnel needs required to monitor and operate district water plants and wastewater plants.

5. Hire and train required personnel to satisfy compliance with the SDWA and CWA.

6. Bring all water systems into compliance with the SWDA and CWA by FY04.

7. Complete a 5-year evaluation of swim beach monitoring program, evaluate training, equipment, and evaluate trends. Produce a report outlining the current status. Look at ways to reduce cost and increase effectiveness of the monitoring.

8. Reinstate routine limnological sampling to identify CWA compliance and assess reservoir water quality problems associated with low flow. Investigate limnological connections that influence sediment quality and impacts to future dredging projects. Analyze existing water quality and sediment quality data to determine trends.

9. Support the division's water quality database efforts and emphasize district operational requirements as the first priority for data entry and data extraction.

10. Improve the quick reaction capabilities and emphasize readiness to support Operations, Construction and Program Management emergency sampling, monitoring, and analyzing requirements if funding is available.

2.3.4.2.Water Quality Status

Objective 1 (District Potable Water Program improvements) Partnering of operations and engineering divisions proved successful in progress towards these goals. Without this cooperative effort there is no doubt the same level of progress could be made. An improved nitrate monitoring program using improved color metric equipment is in use at Ice Harbor. All the required testing for monthly and annual samples were on schedule and the testing is in compliance. The proper tests and authorizations were completed to install a UV treatment system at the Illia community. We anticipate it will be fully functional by mid-FY02 and should complete final testing and acceptance by the end of FY02. A similar UV system was installed at Mill Creek recreation center and has maintained Class A status without violation for 2 years now. The use of UV systems provides the benefits of low cost-low and low maintenance coupled with elimination of hazardous chlorine liquid (STB solution) or chlorine gas. Over the course of five years we hope to achieve a major reduction in both incidence of coliform detection and O&M costs by 60% or greater. A final district operations manual for the water systems should be completed sometime in FY03.

Objective 2 (Develop a district sanitary systems program similar to objective 1) Again the partnering between branches bore the fruits of great improvements. An electronic Discharge Monitoring Report (DMR) was established and timeliness problems with the quarterly reporting are fixed. Last year we discovered the major problem with excessive solids discharges at the Lower Granite and Little Goose sewage treatment systems

stemmed from under loading during the weekend and overloading during the weekday. With the exception of heavy recreation usage during major holidays a consistent uniform nutrient loading of the plant system over the weekend improved overall treatment efficiency by 30% or more. A low cost alternative to nutrient loading is being evaluated at present. Common dry dog food contains the necessary chemical nutrient constituents maintain a healthy activated sludge blanket over the weekend. By flushing a couple of scoops a few times per power plant operator shift a more uniform loading was achieved. The dog food is much less expensive then some of the commercial bio-seed and enzymatic additives used in other plants. Precise totalizing and dissolved oxygen measurements have provided some problems. Improved YSI meters helped this year. A draft operations manual in FY02 with a final in FY03 should complete the specific tasks in this objective. The goal of total operational compliance in FY04 still is on target.

Objective 3 (Identify existing facilities than need permit coverage) Several of the levee pond structures were identified and well as some fish facilities. The Environmental Compliance Coordinator (ECC) for Lower Granite Dam completed the NPDES permit request for Lower Granite Fish Facilities. The other structures will still need to be permitted. The new Phase II rules apply as of April 2003.

Objective 4 (Identify personnel needs required to monitor and operate district water plants and wastewater plants) Requirements were identified by our senior ECC. Several obstacles exist to completing the actual steps necessary to begin object five.

Objective 5 (Hire and train required personnel to fulfill Objective 4) Some of the required training was completed in this fiscal year and additional duties were assigned other personnel as stop gap measures. This is probably the weakest area in our current program because attrition and promotions greatly impact this area. This requirement is key to operating the plants and facilities properly. The division or district water quality steering committee need to raise the priority of this issue.

Objective 6 (Bring systems into compliance by FY04) Adequate progress is being made as evidenced in the previous and further objective status reports.

Objective 7 (Complete 5 year evaluation of swim beach monitoring program and report findings) No progress was made on this objective and it will be carried over to FY02. As of FY03 the requirement will be five years old and meets the criteria for funding under level one baseline.

Objective 8 (Reinstate routine limnological sampling to identify CWA compliance) This is level one baseline and is further part of the implied tasks under the FY02 BIOP. No progress was made on this objective. The district now has the capabilities to do some additional analysis in the lab. Some limited limnological sampling must occur as part of the requirements under: ER 1110-2-8154, ER 1110-2-240, ER 1110-1-263, and NWDR 1110-2-101.

Objective 9 (Support Divisions WQ database efforts) The district participated in all regional meeting and discussions on this matter. We attended the demonstrations of four different products and provided feedback to the various division project managers that have worked on the project. We will continue to support the division efforts by offering our unique technical expertise and provide expert guidance to our water management office's endeavor.

Objective 10 (Improve quick reaction capabilities for better WQ support to District) This was a level two funded item. Since there was not enough funding to support all the level one tasks no progress was made on this objective. In FY02 we expect full level one funding. Bringing our public water systems into compliance and completing these objectives is most critical. Future efforts will be devoted to this and objective 10 will not be carried over in FY02.

2.4. Laboratory and Field Equipment

2.4.1. Regional Office

No laboratory facilities or activities.

2.4.2. Portland District

1. No laboratory facilities.

2. Portland District continued to use the U.S. Forest Service Forestry Sciences laboratory Corvallis, Oregon, to perform chemical analyses on interstitial seep waters from the concrete matrix of Willow Creek Dam, as well as nutrient analyses on samples from the lake.

3. The USGS laboratory at the Water Resources Division was used for calibration, maintenance and repair of TDG saturometers and DCPs for the Fixed Monitoring Stations (FMSs). The District purchased 5 Hydrolab mini-sondes for measuring TDG at the FMS sites.

4. Portland District has 3 Hydrolab H20s and 3 TDG saturometers that are used for routine water quality monitoring.

5. Various contract analytical companies analyzed sediment samples.

2.4.3. Seattle District

1. The Seattle District continued to use a variety of environmental contractors to obtain field samples for biological, physical and chemical testing. A partial list of these contractors include SAIC, North Creek Analytical, AM Test, David Evans and Associates, Striplin Environmental Associates, R2 Resource Consultants, Parametrix, Biomarine Enterprises, and Northwest Hydraulics, BioSonics, HTI, Tetra Tec, HDR., Mevatec, Biomark, Pentec and WES. Federal and State agencies including; USFWS, NMFS and WDFW were also used.

2. Water Management Section maintains its own on-site laboratory for calibration and maintenance of water quality sensors.

3. Twenty-six, including three new Hydrolab sensors are maintained for the Lake Washington Ship Canal to monitor temperature, conductivity and salinity. One multi-parameter probe is maintained to monitor dissolved oxygen at East Bay Marina in Olympia, Washington. Several other multi-parameter sensors and data loggers are maintained for remote monitoring and field-testing. Water Management Section (WMS) has three dissolved gas sensors deployed seasonally upstream and downstream of Chief Joseph Dam and one downstream of Libby Dam. Three additional dissolved gas sensors are used for field studies. WMS maintains several data-logging thermistors for use in special studies.

2.4.4. Walla Walla District

Walla Walla District maintains the capacity to collect water and sediment samples throughout the Division. The water quality program laboratory is capable of performing a broad array of particle size, qualitative, and quantitative sediment analyses. Equipment available includes a two man canoe, a 16' river jet boat, and two 23' GPS equipped aluminum work vessels, a Ford F350 super duty service body truck, an RDI acoustic Doppler profiler, and 50+ water quality multi-probe profilers. There are comprehensive groundwater sampling apparatus, submersible pumps, and biological sample and analysis equipment. The Walla Walla District maintains sediment Ponar and core samplers, winches and other related instruments and equipment. Walla Walla District has the capacity to handle sampling volumes in excess of 100 samples per day. Because of funding issues one 23-foot aluminum workboat will be no longer in service by mid-FY02.

Walla Walla District enhanced the capability of its modest water quality laboratory facility. The laboratory is equipped to handle titration for the calibration of field instruments and QA/QC of total dissolved gas instrumentation. A NIST certified barometer and certified pressure sources insure that the TDG instrumentation is kept at optimal performance. The Laboratory has a comprehensive suite of equipment to maintain and repair Hydrolab, YSI, and total dissolved gas data collection equipment. The new feature of the water quality laboratory is the ability to analyze nutrient samples for the district reservoirs. Parameters include phosphorus, nitrate, ammonia, sulfate, and total nitrogen. The district laboratory can also quantify chlorophyll a and evaluate anions and cations. The laboratory can support a variety of turbidity monitoring equipment in support of dredging and construction operations. The laboratory also monitors and maintains contracts for the analysis of metals and organic contaminants in support of district missions. The laboratory has detailed apparatus for the evaluation of most wastewater parameters. Several microscopes aid in the evaluation and determination of biological samples. Additional equipment purchased and utilized in 2001 included two YSI 5100 oxygen meters, and three digital atomic clocks. We improved the nutrient auto analyzer capability with an auto-sampler. A full complement of sieves, ovens, shakers, and cabinets are operations to allow volume production of grain analysis for future

dredge projects. An additional acquisition included a 2 HP electric mixer for the constant water temperature bath used in calibration and instrument evaluation.

2.5. Data Collection and Analysis

2.5.1. Regional Office

In January of 1996 the water quality collection activities in the Columbia River Basin were turned over to the district offices. The Regional Office serves as the data collection site for the real-time FMS data. The Division Office, through the Water Quality Team (WQT), Reservoir Control Center, Water Management Division continues to coordinate District data collection activities. Tasks performed included the following:

- ✓ Develop an annual plan of action in coordination with the Districts, including number and location of monitoring stations, quality assurance and quality control (QA/QC) protocols for data measurement, data coding and transmission, and instrument calibration and maintenance;
- ✓ Coordinate the start and end dates for the monitoring season;
- ✓ Monitor FMS data received, coordinate with responsible party when an FMS mal-functions, fill data gaps and correct data in the water quality copy of the CHROMS data set which is used for water quality reporting;
- ✓ Prepare daily reports on dissolved gas saturation, water temperature, project spill, pool elevations and total flow;
- ✓ Perform statistical analyses and computer modeling to refine site-specific or system-wide spill versus TDG relationships;
- ✓ Hold a post-season review of Corps monitoring activities with regional participation to discuss details of monitoring activities, receive comments and recommendations and plan for future changes and improvements; and
- ✓ Prepare an annual report on the FMS performance with a discussion of the current year's operations, and recommendations for next year's activities.

The WQT staff also posted information to the regional Technical Management Team (TMT) homepage for dissemination to regional users and researchers, as well as coordinating reservoir regulation details for data collection below Corps projects. The Plan of Action for TDG monitoring in 2000 was included in various documents, including the Corps' Fish Passage Plan and NMFS's application package for state standard water quality waivers.

The annual TDG monitoring report prepared by the Division was based on information received from the district and division water quality staffs and the US Geological Survey. Refer to the Annual TDG Report for a summary of the FMS Program.

2.5.2. Portland District

2.5.2.1.Applegate and Lost Creek Lakes.

In situ water quality data were collected monthly between April and November 2001. Inflow, in-lake and outflow stations were sampled. In situ measurements for dissolved

oxygen, pH, specific conductance, and temperature were taken in the water column with a Hydrolab H20 instrument. Lake water transparency was determined with a Secchi disk. A transmissometer and a nephelometer were deployed monthly through the water column to obtain vertical profiles for light transmission and turbidity, respectively at Applegate Lake. A photometer (unfiltered light) was deployed once a month to determine the extent of down welling irradiance at Applegate Lake.

Water grab samples were collected at inflow and outflow sites and at various depths in the water column at Applegate Lake. Samples were analyzed for dissolved oxygen, chlorophyll a, nutrients, ammonia, fecal coliforms, TSS, TDS, organic carbon, silica, manganese, iron, sulfide and sulfate. The same analyses were performed on incoming tributary and release water samples. This pattern of grab sample analyses alternates between Applegate and Lost Creek Lakes according to year – odd years, Applegate, even years Lost Creek. Water quality data from the two lakes will be used to monitor watershed and lake conditions and in future modeling efforts.

Because of a large algae bloom, Lost Creek lake samples were measured for geosmin to determine if the lake was producing taste & odor compounds at the depth of withdrawal. This was done because a local water district was experiencing taste & odor problems downstream from the project. Geosmin results have not come in yet.

2.5.2.2. Willow Creek Lake.

In situ water quality data were collected monthly between April and November 2000. Inflow, in-lake and outflow sites were sampled. In situ measurements for dissolved oxygen, pH, specific conductance, and temperature were taken in the water column with a Hydrolab H20 instrument. Lake water transparency was determined with a Secchi disk. A photometer (unfiltered light) was deployed once a month from June to September to determine the extent of downward irradiance.

Water grab samples were collected at inflow and outflow sites and various depths in the water column at Willow Creek Lake. Samples were analyzed for dissolved oxygen, chlorophyll a, nutrients, ammonia, fecal coliforms, TSS, TDS, organic carbon, silica, manganese, iron, sulfide and sulfate. The same analyses were performed on incoming and release water samples. The results will be useful for water quality modeling.

Six times, between May and December, water samples collected from throughout the water column were analyzed for methane, methane oxidation, hydrogen sulfide, DO, CO2 and nutrients. Methane analyses were done by portable gas chromatograph.

Interstitial seep waters in the concrete matrix of Willow Creek Dam were sampled monthly in 1999 and analyzed to determine chemical composition. These samples are collected for the Dam Safety Section in support of studies regarding the integrity of the roller-compacted concrete dam.

Locals requested the Corps help them improve temperatures and pH in Willow Creek below the dam. This part of the creek is 303 (d) listed for these parameters. The selective

withrawal device was lowered in the lake and temperature, pH, and DO levels were monitored. The results will be described in an upcoming report. The effort appeared to be a success.

Temperatures in Willow Creek and Balm Fork were monitored at 4 sites upstream of the dam in order to provide data for future modeling and for DEQ's use in determining 303 (d) listing.

2.5.2.3.Elk Creek.

Water temperatures and turbidity were recorded hourly by the USGS at four monitoring sites (Trail, Cascade Gorge, and Alco Creek) on Elk Creek in the Rogue River Basin, Oregon. This work continues a database useful for assessing water quality impacts resulting from the partially completed Elk Creek Dam.

2.5.2.4. Detroit Lake.

The District, City of Salem and USFS began routine monitoring of turbidity in the fall of 1998. The District entered into an agreement with its partners to cooperate in this effort. Monitoring according to the agreement continued this year.

2.5.2.5.TDG Fixed Monitoring Program (FMP).

TDG was measured from mid-March through mid-September for most stations at District projects on the lower Columbia River. A total of 8 instruments were assigned to forebay, tailwater, and downstream stations for John Day, The Dalles and Bonneville Projects. Data was transmitted real time to the Division CHROMS database. This year less than 1 % of the data was lost. The data is important for monitoring compliance with state TDG standards and impacts to fish. The Camas gage was evaluated for representativeness according to requirements of RPA132 of the NMFS Columbia River BiOP. Gas monitors were placed on a transect across the river from the Camas site as well as up and downstream. WES personnel performed this work.

2.5.2.6. Water Quality Monitoring

During Low Flows in the Willamette. Because of draught conditions and at the request of Oregon DEQ, water quality was monitored using a Hydrolab at three sites in the Willamette – Albany, Salem, Newberg Pool. Parameters measured were pH, DO, % DO SAT, Chlorophyll, turbidity, temperature, and conductivity.

2.5.2.7. Dredged Material Projects.

Sediment samples were obtained during FY 2001 at the following federal navigation projects in the Columbia River, and along the Oregon coast: Skipanon Channel, Oregon Slough, VANALCO, CRCR #76 resample, Astoria EBB, Umpqua River, Siuslaw River, Chetco River and Coquille River. Bulk physical and chemical analyses were performed on samples to determine compliance with water quality standards and, in some cases, suitability for ocean disposal. Physical and chemical tests were conducted in accordance with Corps of Engineers and Environmental Protection Agency water/sediment analytical guidelines (Dredge Material Evaluation Framework-DMEF). Sediments were collected with several types of sampling equipment, including box core surface sampler, gravity and vibra corers.

Physical tests included particle-size distribution, percent volatile solids, void ratio, specific gravity, and re-suspended density. Sediments were also tested for priority-pollutant heavy metals, pesticides, dioxin/furan, PCBs (polychlorobiphenyls), PAHs (polynuclear aromatic hydrocarbons), organotin (TBT), TOC (total organic carbon), phenols, phthalates and miscellaneous extractables.

2.5.3. Seattle District

1. Water quality monitoring continued at all District projects. Real-time water temperature, salinity, dissolved oxygen, and total dissolved gas data were transmitted to the District and Division offices. These data were supplemented by field turbidity measurements at Howard A. Hanson and Mud Mountain projects. The automated salinity sensors installed in the Lake Washington Ship Canal were ground-truthed periodically to ensure accuracy.

2. The management of the water quality database was transferred to the Portland Division Office. The Seattle District Office will continue to perform the data collection and maintenance of the sensors.

3. During the summer conservation season, additional water quality data were collected at Howard A. Hanson reservoir and the Lake Washington Ship Canal. In-situ measurements of temperature, dissolved oxygen, pH and specific conductivity were collected at various depths in the water column. The City of Aberdeen collected similar data for Wynoochee reservoir and furnished copies of the data to the District. The data were used to monitor reservoir thermal stratification at Wynoochee and Howard A. Hanson reservoirs and saltwater intrusion and dissolved oxygen concentration in the Lake Washington Ship Canal.

4. Water quality data collection at Libby Dam was performed by contract with the U.S. Geological Survey. This sampling program consisted of analyses for total phosphorus, orthophosphate, nitrate, total Kjeldahl nitrogen, silica, metals, salts, heavy metals and nitrogen saturation. Vertical profile measurements of temperature, specific conductance, pH, alkalinity and dissolved oxygen were also performed.

5. Water quality and wastewater evaluations were included in the Environmental Compliance Assessment of Libby Dam.

6. Water quality analysis at La Push for the Quillayute Project. The goal is to replicate studies performed in the 1980's to assess changes over the past twenty years.

7. Seasonal water quality monitoring data is collected at one station in the East Bay Marina, Olympia Harbor, in South Puget Sound. Data is reviewed to determine when the Port of Olympia must operate its mechanical aeration system to increase dissolved oxygen levels to levels that are not harmful to fish.

8. District staff continued to collect water and crab data at Grays Harbor Channel and near-shore disposal sites.

9. ERS supervised 8 separate agencies or organizations in a basin-wide monitoring program using passive-integrated transponders (PIT tags) of juvenile salmon migration from tributaries to Lake Washington through the estuary in Shilshole Bay.

10. R2 Resource Consultants and ERS collected water quality data and sampled juvenile fish abundance in side channel habitats of the Green River and Sammamish River.

11. The District staff collected water quality data around the locks to determine how the lock operations effect water quality upstream of the locks.

12. R2 Resource Consultants collected fish habitat data in the mainstem of the Green River.

13. R2 Resource Consultants surveyed the mainstem Green River below Howard Hanson Dam for bull trout.

14. R2 Resource Consultants built and operated a scale model of a fish passage facility planned for Howard Hanson Dam. Data was taken on juvenile salmon behavior and downward flow fields.

15. ERS and King County completed a juvenile salmonid habitat use survey in the Sammamish River.

16. ERS, NMFS, WDFW collected pit tag information at the smolt flumes at the locks for outmigrating juvenile salmon.

17. Mevatec evaluated smolt entrainment of the Large Lock filling culverts using hydroacoustics.

18. ERS conducted beach seining in the lower Chehalis River for bull trout. The work is to validate the USFWS dredging window.

19. The City of Seattle and ERS conducted substrate studies at Seward Park, Lake Washington to determine preferred shoreline habitat for juvenile salmon.

20. The City of Seattle, King County and ERS conducted juvenile salmon studies in the estuary below the Hiram Chittenden locks.

21. ERS completed gravel survey studies for the Cedar River.

2.5.4. Walla Walla District

1. Six multiple level thermister data buoys have been in operation since May 1. They are operating in McNary Dam forebay collecting hourly temperature data at multiple depth levels. After analysis of the data and operations we have planned to automate the temperature strings with GOES and restructure the sensor locations. Additional depth transducers will be added to the existing strings.

2. Drinking water was sampled monthly for coliform bacteria at Little Goose and Lower Granite. Additional tests were performed for organic and inorganic substances to meet monitoring requirements.

3. Wastewater was also sampled at Little Goose and Lower Granite Dams in accordance with (NPDES) National Pollution Discharge Elimination System. Discharge Monitoring Reports which include effluent loading and quality were prepared monthly and mailed quarterly to EPA. Tests were performed at the lab in Walla Walla to improve project wastewater processes. Recommendations were made and procedures implemented to improve compliance with permit criteria.

4. No sediment sampling was conducted this year. This year was spent evaluating and performing QA/QC on existing data prior to implementation of the NWW SEDQUAL database. Much of the credit for our success goes to Mr. Martin Payne of the Department of Ecology for the software implementation and training and to Mrs. Laura Hamilton of Portland District who provided to us a standardized user's manual for Corps personnel. That document provided us with a simple easy to follow guidance document for setting up Corps specific, surveys, stations ID, and meta data entries.

5. Total Dissolved Gas was monitored at 16 stations located in the forebay and tailwater of District projects to determine gas levels resulting from various project spill events. Data was transmitted to the CROHMS database.

6. During the summer and fall temperature loggers were used to collect water temperatures at in the adult fish ladders and in the juvenile system at the Walla Walla District Projects. The loggers were attached to a rope and lowered in the water approximately one foot from the bottom. The data loggers were set to record water temperature once per hour. The project biologists download the data to a shuttle. The district plans to publish a report detailing the temperature monitoring at the ladders and the fish facilities throughout the year for each year. Evaluation of the data and drafting of the report is on going as this document goes to press.

2.6. Water Quality Reports

2.6.1. Division Office

Annually the Division Office publishes this comprehensive report and a separate report for Total Dissolved Gas Monitoring in the Columbia Basin.

2.6.2. Portland District

1. Larson, Douglas W., June 2001. Willamette Reservoirs Oregon: Hills Creek, Lookout Point, Dexter, Fall Creek, Dorena, Cottage Grove, Fern Ridge: Limnological and Water Quality Studies 1950-2000 Final Report.. Harris, K. L. and Britton, J. L. 2001. Delta Ponds, Oregon Ecosystem Restoration Feasibility Report and Environmental Impact Assessment. Water Quality Section.

2. Harris, K.L. and Britton, J. L. U .S. Army Corps of Engineers, Portland District. Draft 2001. Willamette River Temperature Study – Summer 2000.

3. Tanner, Dwight. USGS. December 2001. Quality Assurance Data, Comparison to Guidelines, and Site Considerations for Total Dissolved Gas and Water Temperature, Lower Columbia River, Oregon and Washington, 2001. Water-Resources Investigations Report 9x-xxxx.

4. Sherman T. J, U. S. Army Corps of Engineers, Portland District. 2001. Astoria East Boat Basin, Sediment Quality Evaluation.

5. Sherman T. J, U. S. Army Corps of Engineers, Portland District. 2001. Umpqua River, Sediment Quality Evaluation.

6. Sherman T.J., U. S. Army Corps of Engineers, Portland District. 2001. Siuslaw River Sediment Quality Evaluation.

7. Bahus K., Technical Writing and Research. 2001. Chetco River Sediment Quality
8. Evaluation.

9. Bahus K., Technical Writing and Research. 2001. Coquille River Sediment Quality Evaluation.

10. 10.Bahus K., Technical Writing and Research. 2001. VANALCO (Former Aluminum Plant) Sediment Quality Evaluation.

11. 11.Bahus K., Technical Writing and Research. 2001. CRCD #76 Re-sample Sediment Quality Evaluation.

12. 12.Bahus K., Technical Writing and Research. 2001. Skipanon Channel Sediment Quality Evaluation.

13. 13.Bahus K., Technical Writing and Research. 2001. Oregon Slough Sediment Quality Evaluation.

14. West Consultants (GeoSea, subcont.) U. S. Army Corps of Engineers, Portland District. 2001. A Sediment Trend Analysis and an Acoustic Bottom Classification In the Mouth of the Columbia River: Implications to Dredged Disposal Operations and Coastal Erosion.

15. Parametricx, Inc. (Sea Floor Mapping, subcont.) U. S. Army Corps of Engineers, Portland District. 2001. Seafloor Mapping Survey, Proposed Deepwater Disposal Site, Offshore Columbia River, Oregon.

16. Hamilton, L., U. S. Army Corps of Engineers, Portland District. 2001. MCR ODMDS Deep Water Site Baseline Sediment Characterization Study.

17. Siipola, M., U. S. Army Corps of Engineers, Portland District. 2001. (Draft and Final) Yaquina Bay Ocean Dredged Material Disposal Site Evaluation Study and Environmental Assessment.

18. Sherman, T. U. S. Army Corps of Engineers, Portland District. 2001. MCR Sediment Quality Evaluation.

2.6.3. Seattle District

1. Seattle Districts, Annual Water Quality Report, December 2000. This report is incorporated in the Division Annual Water Quality Report.

2. ERS and Waterways Experiment Station completed two manuscripts on research studies conducted at the Hiram M. Chittenden Locks, which were published in the American Fisheries Society book "Behavioral guidance Technology". The manuscripts were two chapters in the book and were entitled: "Evaluation Of Strobe Lights For Vertically Displacing Juvenile Salmon Near A Filling Culvert Intake At The Hiram M. Chittenden Locks", Seattle, WA and "Evaluation of Low-Frequency Sound Emitters for Guiding Salmon Smolts Away from a Navigation Lock".

3. HTI completed a draft report on adult fish passage at the Hiram M. Chittenden Locks during 2001.

4. BioSonics completed a report on fish use of the saltwater drain and spillway at the Hiram M. Chittenden Locks entitled: Acoustic and Video Measurements of Fish Passage at the Hiram M. Chittenden Locks: A Year 2001 Focus on the Salt Water Drain and Spill Bay #2.

5. WES and ERS completed a report on smolt passage through the Hiram M. Chittenden Locks following completion of the Lake Washington Ship Canal entitled: Fish Passage Investigations at the Hiram M. Chittenden Locks in 2001.

6. R2 Resource Consultants completed a report on smolt monitoring in Lake Washington entitled: Pit Tagging of Juvenile Salmon Smolts in the Lake Washington Basin: Year 2001 Pilot Study Results.

7. R2 Resource Consultants completed a report on Juvenile Salmonid Use of Lateral Stream Habitats of the Middle Green River, Washington (Appendix A – 2000 Day/Night Electrofishing Survey Summary Data).

2.6.4. Walla Walla District

1. Quality Assurance and Quality Control for Total Dissolved Gas Monitoring-Lower Snake River, Washington; Clearwater River, Idaho; and Columbia River, Oregon and Washington, 2001.

2. Preliminary Final Lower Snake River Juvenile Salmon Migration Feasibility Report/Environmental Impact Statement, Appendix C Water Quality, U.S. Army Corps of Engineers, Walla Wall District 2001.

2.7. Data Management System

2.7.1. Division Office

All water control and water quality data are stored in a HEC-DSS database. Data are available in both DSS and 132 column formats. DSS utility programs are routinely used to store, list, display, and manage the data. Hourly total dissolved gas, water temperature, project flow and project spill data are posted on the Technical Management Team's homepage (http://www.nwd-wc.usace.army.mil/TMT/index.htm)

2.7.2. Portland District

1. Portland District enters water quality data into a Microsoft Access relational database.

2. The District, along with Seattle and Walla Walla, worked with Division to consider database alternatives and to screen pre-packaged databases for potential Division-wide use. A variety of software packages are currently being presented to the Northwestern Division for consideration. Possibly, each District may adopt their own database that could be linked to the Division office via a WEB site. Portland District is also considering adopting a "packaged" water quality database to replace the current one.

3. Water quality data are available via the District WEB site under the Water Management page. Ralph Almeria with the Northwest Division office is responsible for maintenance of the data access.

2.7.3. Seattle District

1. Hydraulics and Hydrology Section's primary data management is a microcomputer database using HECDSS with a user-friendly Visual Basic front-end. This database system has facilitated access and communication with the District's water control and water quality data collection system and has improved accessibility for data analysis and presentation. As of FY 2001, the Northwestern Division Office

maintains a homepage that makes much of this data available to the public via the Internet. Data collection continues to be performed by Seattle District Office.

2. The Dredged Analysis Information System (DAIS) stores chemical and biological testing data submitted for proposed dredging projects. These data are used by the Dredged Material Management Office and other participating Dredged Material Management Program (DMMP) agencies to make suitability determinations for disposal of dredged sediments at eight open-water disposal sites in Puget Sound and three open-water disposal sites each in Grays Harbor and Willapa Bay. Automated reporting features are also available in DAIS, including reports summarizing sampling, testing, and administrative data. ArcView software is used for geographic information system (GIS) queries.

3. BioStat (a bioassay statistics program) was created by Seattle District to automate the interpretation of biological testing data in sediment assessments. The use of the software provides consistency in data interpretation for dredged material testing evaluations.

4. Regulatory Branch uses the Regulatory Analysis and Management system (RAMS) to track fills in wetlands and required mitigation.

2.7.4. Walla Walla District

2.8. Research and Development

2.8.1. Division Office

The Division office was involved in efforts with the Walla Walla and Seattle Districts, reviewing the current numerical modeling capabilities with a focus on how each model available serves the needs of the region. Different models have been developed, with data from specific years and weather conditions, for long range planning and prediction as well as for use as operational decision making tools. These models are being reviewed and tentative plans are being drafted to implement these tools into a cohesive management plan. Numerical models under review are SYSTDG, MASS1 and MASS2.

2.8.2. Portland District

1. Temperature loggers were deployed below select Willamette Projects and in the mainstem to determine if project flows could influence mainstem temperatures.

2. Temperature loggers were also deployed in Willow Creek and Balm Fork to provide data for future lake water quality modeling and to provide data for future TMDL and listing concerns.

3. Water and sediment samples were measured for PCBs at the Bradford Island disposal Site located at the Bonneville project. A relatively new technique, using polyethylene sheets, was used by Battelle to sample Columbia River water for PCBs.

2.8.3. Seattle District

1. ERS conducted crab population surveys in outer Grays Harbor. These surveys will help identify crab use of different water and sediment habitat types.

2. In 1999 a report, which was prepared by the District, recommend strobe lights as a restoration feature under the Lake Washington Ship Canal Section 1135 Feasibility Report. The operation of the strobe lights was scheduled for 2000 but due to mechanical malfunctions in the lights, the strobe lights could not be operated. The contractor replaced the strobe lights in November 2001. Operation of the strobe lights is planned for the 2002 season.

3. ERS, in cooperation with the WA Department of Fish & Wildlife, Muckleshoot Indian Tribe and King County, continued monitoring studies on the use of modified locking procedures and the effectiveness of barnacle removal (in conduits of the large lock) at the Locks to improve survival of salmon smolts migrating through the Locks. Analysis of study results was used to confirm the effectiveness of slow locking procedures and barnacle removal, which were recommended for implementation under the Lake Washington Ship Canal Section 1135 Feasibility Report. The Corps has applied for construction funding for 2003 under Operations funds.

4. In cooperation with R2 Resource Consultants, Washington Department of Fish and Wildlife, National Marine Fisheries Service, University of Washington, Muckleshoot Tribe, King County and City of Seattle, District personnel are conducting a study on juvenile salmon migration using passive-integrated transponders (PIT tags) through the Lake Washington and Shilshole Bay systems. Data will be used to assess needs for additional water under the Lake Washington GI study. A final report is scheduled for early 2002.

5. The Corps of Engineers performed velocity and water quality studies around on the locks and 1,000 feet downstream. This study was to determine the flow patterns, velocities, and water quality conditions in the estuary immediately below the Locks.

6. In cooperation with HTI, Seattle District personnel conducted a study of adult Chinook salmon use of saltwater habitats immediately upstream of the large log chamber. The study used acoustic tags and a linked-hydrophone array, the first application of the linked array in saltwater. The data will be used to assess lock operations on water quality and linked impacts to Chinook salmon behavior.

7. In cooperation with R2 Resource Consultants, Seattle District personnel conducted a study of juvenile salmon behavior in a scale model of a fish passage facility planned for construction at Howard Hanson Dam: the model structure was a “fish lock”.

8. ERS continued to collect surf smelt population and breeding area surveys at LaPush, WA, to identify surf smelt use of areas that have been rebuilt with dredged material from the Quillayute harbor project.

9. Seattle District sponsored the Skagit System cooperative to analyze riprap impacts on the Skagit River.

2.8.4. Walla Walla District

1. Hydrology branch in conjunction with the Pasco office of the USGS and HDR engineering is further developing the capabilities of the automated catamaran buoys for water quality analysis. The Russ Heaton is currently completing the design memorandum and specifications for the Mark II system. Existing Mark I systems could be upgraded to this standard once the naval architecture prove seaworthy. Russ Heaton, Mr. Andy Records (Tacoma USGS), and Mr. Greg Ruppert (Pasco USGS) are developing a wireless SDI-12 system to transmit direct data from submersed probes to a shore-based high data rate GOES transmitter.

2. Mr. Jimmy Brown (Natural Resources), Dr. Frank Tumor (Lower Granite Project), and Russ Heaton (Hydrology) are moving forward with installation of in-line ultra violet radiation systems to the district's potable water plants. In FY02 final engineering sample tests will be used to validate the Illia system. Future water quality objectives could include additional installations where feasible to other district projects. Tests and a validation report should be completed in FY03 and could be used as an exhibit to feasibility at other sites. Detailed cost saving quantification will be included as a comparison to the older chlorine residual systems. Culmination of this R&D project may include a revised operations manual and different training and certification proposals to the State for these special systems.

3. Russ Heaton is designing and developing an improved TDGMS sonde for the total dissolved gas-monitoring program. The new sondes will have a depth total accuracy of 0.01 feet from 1 to 10 feet and 0.02 feet from 11 to 90 feet. The absolute accuracy for the temperature sensor will be 0.05 degrees Celsius over the range of –5 to 27 degrees. The dissolved oxygen absolute accuracy will be 0.1 mg/L and the TDG sensor will have an absolute accuracy of 0.1 mmHg. Along with this the target goal to provide stable readings between calibrations for 6 to 8 weeks. Another value added feature will be the process of batch calibration using improved automated calibration methods. This should at a minimum provide justifiable, reproducible data, precision, and accuracy to operationally go to monthly calibration cycles. NWW feels this is a critical need because O&M costs continue to increase with inflation and there is currently a budget shortfall for O&M of the TDGMS. The redundant monitoring Reasonable Prudent Action (RPA) measure of the National Marine Fisheries Service (NMFS) biological opinion will give this district no choice but to go to an extended maintenance cycle to stay within budget. Additionally, in the event adequate funding is provided to retain two-week calibration cycles improved instrumentation will improve reliability of

existing monitoring stations. Most cooperating agencies will agree improved reliability and accuracy is vital to a comprehensive QA/QC program because of the need to operate to the 10^{th} of a percent saturation. Our current equipment after calculating total cumulative error to a 95% confidence interval cannot meet the 10^{th} of a percent specification.

2.9. Water Quality Problems

2.9.1. North Pacific Region

1. Since it's 1998 Supplemental Biological Opinion, NMFS calls for water to be voluntarily spilled up to the full 120% TDG level at the Corps' mainstem Columbia and Snake River dams during the spill season. NMFS pursued and obtained waivers with the states and tribes to spill to the higher TDG levels.

2. Compliance with the State TDG standards is a recurring issue with no easy solution in sight. In some cases, water entering Corps and other federal reservoirs is already supersaturated. Any further increase in spill, either to provide a safer passage route to fish or to accommodate limited plant capacities, can only further exacerbates TDG conditions. Given the sensitivity of the spill and the related TDG issue, TDG data continued to be closely scrutinized by various agencies and interest groups. As a result, the demands on the monitoring program increased significantly. Because of limited plant capacity spill is required at most Lower Snake River dams as soon as flows exceeded 100 kcfs. Decreasing spill through upstream storage or passing more water through the powerhouse is not always feasible. The need to operate all turbine units at flows within 1 percent of their peak efficiency flow to avoid more extensive damages to fish contributed to a *de facto* decrease in powerhouse capacities.

   Waivers were obtained from the states to allow for the spill for-fish-passage to occur. The Oregon and Washington waivers applied to the March 23 - August 31 period; and the Idaho waivers, to April 15 – June 1, June 18 – July 15 and August 16 – August 31 periods. The Oregon Environmental Council did not, however, grant TDG waivers for the for the Spring Creek Hatchery release, March 13-23.

3. The NMFS's Water Quality Team (WQT) continued to provide a forum for peer review and technical exchange of information on TDG. Although advisory in nature, the NMFS WQT also played an active advocacy role. The NMFS WQT reviewed and commented on the 2001 Plan of Action and TMT Spill Management Plan, as well as participating in the TDG post-season review meeting.

4. The Transboundary Gas Group met in March and October. Discussion subjects included treaty obligations and limitations, TDG monitoring and abatement measures on the Canadian side of the border and monitoring issues on the US side of the border.

5. EPA, the states and the tribes coordinated on a combined approach to TMDL issues in the Columbia and Snake River mainstems. The Corps attempted to keep abreast of these issues and provide support where feasible. The initial TMDL effort is focused on TDG and water temperature.

6. Many of the water quality programs in the North Pacific Region continued to be driven by design and/or operational actions associated with the salmon and steelhead recovery effort.

2.9.2. Portland District

1. Willow Creek Lake, Oregon is eutrophic and by August, the reservoir's hypolimnion is anoxic containing high concentrations of hydrogen sulfide, methane, ammonia and other chemically reduced substances. Phytoplankton blooms aggravate water quality problems in the impoundment. A recent report analyzing trends in the limnology of the lake suggests that conditions are improving (Willow Creek Lake, Oregon Limnological and Water Quality Studies 1984-1996 Final Report, April 1997). However, this year methane levels increased over previous years suggesting that a declining trend may be questionable. The fluctuations in methane production need to be further examined to provide direct links to lake limnology. High nutrient input to the lake from the watershed continues to be a problem. Monitoring data shows inputs of phosphorus and nitrogen from Balm Creek and Willow Creek. Cracks and voids in the dam concrete matrix provide avenues for leakage of hypolimnetic waters. Seepage entering the dam's tunnels and gallery is enriched with hydrogen sulfide and dissolved lime. There were concerns that oxidation of hydrogen sulfide and ammonia by chemosynthetic bacteria is producing sulfuric and nitric acid, respectively, that could be corroding the concrete in the dam. Deposition of calcium carbonate on the gallery walls and floors could be potential signs of corrosion. Studies in the late 1980s were completed on the geochemistry, microbiology, and hydrodynamics of seepage waters to determine whether the structural integrity of the dam is at risk. These studies, combined with other engineering analyses, including petrographic studies, indicate that the dam is safe. Yearly monitoring of seepage continues along with limnological surveys of Willow Creek Lake.

   Willow Creek (below the lake) is on the State 303(d) list for temperature and pH. This year temperature improvements below the dam were again achieved by lowering the selective withdrawal device in the lake.

2. Cougar Project. The U.S. Fish and Wildlife Service and Oregon Department of Fish and Wildlife reported in 1988 substantial reductions in the number of anadromous fish using the McKenzie River in the Willamette River Basin. The agencies attribute much of this reduction to Corps of Engineers impoundments, claiming that water released from these projects tends to be thermally sub-optimal for fish migration and reproduction. Thus, the agencies have urged the Corps to provide more favorable release-flow temperatures at projects on the McKenzie

River (Cougar and Blue River) for the purpose of improving habitat and thereby sustaining larger fish populations downstream. The greatest threat to the chinook occurs in the fall when water 10 degrees F warmer than the river temperature are released from an outlet near the surface of the reservoirs. Other reservoirs in the Willamette System (Hills Creek, Fall Creek, Lookout Point, Green Peter and Detroit) may affect downstream water temperatures in ways that impact anadromous fish as well.

Construction of the Selective Withdrawal Structure at Cougar has been approved and construction is slated to begin in spring of 2001 with tapping of the tunnel scheduled for the winter of 2002. The structure is designed to improve downstream temperatures for fish.

3. State 303(d) Listings. In 1998 the Oregon Department of Environmental Quality (DEQ) released a new 303(d) list of "water quality limited waters". Some District reservoirs and stretches of river below reservoirs were on the 303(d) list. Interpretation of the reservoir listings is straightforward. However, listings of rivers below the reservoirs are subject to interpretation. The impact of a reservoir on downstream conditions must be evaluated on a case-by-case basis. For instance, the Coast Fork Willamette is listed for high summer temperatures from the mouth to Cottage Grove Reservoir, but the reservoir releases water in mid August that is below the 64° F Standard. In this case, the reservoir may actually be helping to make the problem less severe in a specified reach of river below. District projects with associated in-lake and downstream water quality problems described in the DEQ 303(d) list are given in Table 7 below.

Table 6. NWP Water Quality Problems on DEQ 303(d) List

Reservoir	Res. Parameter(s)	Below Res. Paramater(s)
Applegate		Flow, Temp. (summer)
Cottage Grove	Toxics – tissue, water	Temp. (summer)
Dorena	Toxics – tissue, water	Temp. (summer)
Fall Creek		Temp. (summer)
Dexter		Temp. (summer)
Fern Ridge	Turbidity, Bacteria	Temp. (summer), Bacteria
Blue River		Temp. (summer)
Cougar		Temp. (summer)
Willow Creek		Temp., PH (summer)
Bonneville		Toxics, pH, Temp.,TDG
The Dalles		Temp., TDG
John Day		Temp., TDG
Elk Creek		Temp. (summer)

Water, sediment and fish from Cottage Grove Reservoir contain elevated levels of mercury. The mine tailings from Black Butte Mine about 8 miles above the reservoir are the probable source of mercury. Some fish in the reservoir exceed the FDA action limit for mercury in muscle. Studies have been conducted to determine the loading and distribution of mercury in the water, sediment, and food chain. The State of Oregon has issued a Health Advisory concerning consuming fish from Cottage Grove Reservoir.

Fish in Dorena Reservoir contain high concentrations of mercury but for a less obvious reason than fish at Cottage Grove. Although some fish exceed the FDA action limit, concentrations are not as high as in fish from Cottage Grove Reservoir. High mercury levels may be related to the historic use of mercury in the process of refining gold in the Dorena watershed. However there is no direct evidence to support this view. The State of Oregon has issued a Health Advisory concerning consuming fish from Dorena Reservoir

4. Total Dissolved Gas (TDG) supersaturation in the Lower Columbia River continues to exceed the 110% water quality standard below projects (John Day, The Dalles and Bonneville). Increased spill to promote fish passage has contributed to this problem. In the past, spill was minimized to try to keep TDG within the standards. TDG levels were substantially lower in 2001 because of reduced flows due to the draught. In late 2001 and early 2002 new flip lips will be installed at Bonneville, which should improve gas levels below this project.

5. Willamette River Projects are believed to exceed TDG standards under limited discharge scenarios. Data from Green Peter and Foster Reservoir collected during high flows TDG concentrations greater then 110% immediately below the dams. Water at Harrisburg and Salem during this period hovered around 100 % TDG well below the standard.

   Most of the Willamette Projects experience algae blooms of blue-greens in July and August. So far , these have not reached the nuisance stage that would lead to strong taste and odors or organic loading in water below the projects.

   According to the NMFS Willamette River Biological Opinion on threatened Salmon and Bull Trout, Willamette Projects operations affect habitat and water quality below dams because of changes in stream hydrology. Changes in riparian habitat and aquatic ecology may be impacting fish.

6. Columbia River Projects, according to a NMFS Biological Opinion on threatened Salmon and Bull Trout, affect habitat and water quality in and below dams because of project operations. Total dissolved gas and temperature are the main culprits, but other water quality variables may also impact threatened and endangered species.

Bradford Island disposal site at Bonneville is a source of PCBs and other contaminants to the Columbia River. PCBs have been found in clams (Corbicula) and in crayfish residing on the site.

7. Rogue River Projects. This year, a severe algae bloom occurred at Lost Creek Reservoir late in the summer. Water samples were taken by the monitoring contractor and shipped off to a university lab in Ohio to analyze for microcystin, a toxic substance produced by Aphnizomenon.

2.9.3. Seattle District

1. While water quality problems often include high turbidity at Howard Hanson and Mud Mountain Dams, no problems were reported due to the drought.

2. The Locks provide cool water refuge upstream of the large lock that may be critical to adult salmon survival. The role of the saltwater drain/lockages to provide cool, oxygenated water will need to be evaluated to optimize opportunities to improve water quality either through modifications of the saltwater drain or through operational changes at the locks.

3. The Sammamish River has naturally high temperatures during the late summer/fall, the time for salmon migration. The Lake Washington GI study will evaluate means of reducing temperatures to within the non-lethal range for salmon.

2.9.4. Walla Walla District

1. Improvements were made in the operation of wastewater plants at Little Goose and Lower Granite Dams. It was determined that there is no hydraulic overloading on the present systems as had been previously postulated. Hauling off of accumulated sludge in the effluent tank at Lower Granite and adjusting the food to microorganism ratio of the aeration tank at Little Goose resulted in significant improvements in effluent quality. Maintaining a pool of trained personnel with applicable certifications remains a problem that stands in the way of completing our water quality objective of compliance by FY04.

2. Drinking water quality is still a major concern at Ilia Community near Lower Granite Dam. Coliform bacteria presence was again seen on several occasions when the chlorine injection system failed. Additional tests were performed on all wells before chlorination at Lower Granite and Little Goose areas. Results showed that total and fecal coliforms at all wells were less than 3. We believe the ultra violet radiation system should correct the problem and provide additional cost saving from and O&M stand point.

3. High TDG (total dissolve gas) levels remain the primary water quality problem in the Walla Walla District. TDG data was collected at the tailwaters of the four Lower Snake River and McNary dams. Last year was an unusually dry year with flows well below normal. Data reviewed for Lower Snake River and McNary dams January through October 2001 showed only two incidences of TDG super saturation

above the proposed TMDL limits. Generator testing was conducted on one of those occasions coupled with from upper dams may have caused the TDG increases.

4. Concrete deflectors can help reduce TDG. Ice Harbor and Lower Granite have full flow deflectors. Four endbay deflectors are currently being constructed at McNary Dam. Endbay deflectors are scheduled for construction at Lower Monumental Dam spring of 2002 and are currently being designed for Little Goose Dam.

5. Because of the low flow last year showed significant examples of eutrophic conditions in the fore bays and sloughs of the four Snake River dams. Dissolved oxygen sensors on the TDGMS identified the stratification potential and we were able to predict oxygen depletion rates. A few profiles confirmed shifts in oxidative reduction coupled with pH shifts. In early July some private citizens reported large blue-green algae blooms in the Lower Granite Pool. Clarkston Resource personnel provided samples of *Aphanizomenon sp.* in early May. Other samples were looked at in July, August and September. Blue-green communities were dominant in the oligotrophic Dworshak samples. The inoculation of cyanobacterium into the nutrient rich and warm Lower Snake River provided a fine example of natural community succession in a lake environment. Once the flows dropped the reservoirs quickly took on the characteristic of a lake. Further evidence obtained from a few zooplankton samples indicated a potential correlation of community shift from *Cladocera to Copopoda* as the *Chlorophyta* died off and was quickly replaced by *Cyanophyta*. Unfortunately because of funding this uncommon event was not studied or quantified therefore nothing is publishable. In the future it is necessary to quantify the changes in community shift to establish some minimum flow regimes to protect water quality and juvenile endangered fish species. Better planning is necessary top provide a contingency to evaluate uncommon events with potential problems.

2.10. Special Studies

2.10.1. Division Office

2.10.2. Portland District

1. Willamette Temperature Study. Temperature loggers were deployed in tributaries to Green Peter, Lookout Point, Cottage Grove, and Dorena as well as in the outflow from Hills Creek to gather data to assist the state of Oregon in a modeling effort that will be used to determine temperature TMDLs for the Willamette River.

2. Willow Creek Water Quality Improvement. Water temperature and pH in Willow Creek below the reservoir are elevated above Oregon Water Quality Standards during the summer months. The city of Heppner asked the Corps to operate the selective withdrawal device built as part of the reservoir project in order to improve water quality in Willow Creek. A multiparameter water quality probe (Quanta by Hydrolab), was deployed in the tailwaters of Willow Creek Reservoir to monitor

temperature, dissolved oxygen (DO), and pH of the release waters. Water temperature probes were also deployed upstream of the reservoir in two creeks, Balm Fork and Willow Creek in their headwaters and immediately above the reservoir. A test of the selective withdrawal device indicated the depth should be kept at 17 ft to release high quality water. Hydrogen sulfide was tested in mid-summer and showed non-detectable levels of that parameter in the discharge waters.

3. The Delta Ponds 206 Study ecosystem restoration project was concluded in the fall of 2001. The plan is to reconnect the ponds to the Willamette River to improve flows through the system and reduce stagnant conditions that lead to poor water quality. Channels and culverts will connect the ponds, and side banks cleared of black berries and reconfigured to a 3:1 slope.

4. Camas TDG Study. A study of the Total Dissolved Gas (TDG) concentrations in the Columbia River between Bonneville dam and Camas was undertaken to determine if the Camas gas monitoring site is representative and to scout for possible new sites for Camas and the tailwater sites below the dam. Additionally temperature, oxygen, and weather data was collected to determine the impacts of non-dam variables on gas production in the reach below the dam. It was found that temperature, atmospheric pressure, wind, and biological gas production impact gas levels at Camas.

5. Dredge Material Modeling. Mathematical modeling studies (MDFATE) of dredge material disposal were performed at an Ocean Dredge Material Disposal Sites off the mouth of the Columbia River. The resulting modeled bathymetry was then fed into RCPWAVE to determine if the simulated disposal mounds would have any adverse effects on the wave climate in the area of the disposal sites.

6. Lower Columbia River Dredged Material Evaluation Framework. Because of Endangered Species issues and evolving concerns with dredging and dredged material placement revisions to the DMEF are considered necessary. Representatives of various federal (COE, EPA, USFWS, and NMFS) and state (ODEQ, WDOE, and WDNR) began discussions on areas requiring updating.

2.10.3. Seattle District

1. Olympia East Bay Marina Water Quality Mitigation. The East Bay Marina Dissolved Oxygen Monitoring and Aeration System has been operated and maintained by the Port of Olympia since project construction in 1983. An automated water quality sensor was installed in 1991 at the project. The sensor is removed during winter months and reinstalled each summer. The data are transmitted by the District's water control data collection system and then furnished to the Portland District Office, the Corps' project manager and Port of Olympia. The District continues to review the water quality monitoring data, which is used by the Port of Olympia to determine when to operate their mechanical aeration system.

2. Howard Hanson Dam Additional Water Storage Project Study. The District Completed the Record of Decision for the final EIS in 1999, which included the evaluation of possible impacts to sedimentation and water quality resulting from a proposed increase in the summer conservation pool at the project. The additional water stored would be used for Tacoma's municipal water supply and higher instream flows for fisheries. The water quality studies were geared toward sediment transport, turbidity analyses and outflow temperature. The recommended project should not adversely affect water quality and will probably improve downstream river temperatures. An additional benefit of low-flow augmentation would be to slow salinity intrusion upstream of the Duwamish Estuary. This project is currently in the Preliminary Engineering Design Phase. The District continues to study the impact of additional water storage on turbidity at Howard Hanson Dam. In 2001, H&H conducted a thermal budget analyses for the PED phase of the project.

3. Libby Dam - Kootenai River Sturgeon. Libby Dam was operated to meet the flow objectives of the 2000 US Fish and Wildlife Service and National Marine Fisheries Service Biological Opinions. The flow regimes were coordinated through the Columbia River Technical Management Team. A minimum of 6,000 cfs was maintained for Bull Trout throughout the summer and spring. Due to the drought, there were no additional flows for Columbia River White Sturgeon this year. Spilling at Libby Dam may result in very high levels of dissolved gas supersaturation and damage to downstream fish. However, spill for flood control has not occurred in the past decade.

4. Mill Creek SAMP. District staff continued to work on the draft wetland management and restoration plans for the Mill Creek Basin. The plan incorporates the King County Surface Water Management Plan and the Mill Creek Water Quality Management Plan and emphasizes maintaining and improving the water quality functions of the Mill Creek Basin's wetlands. The restoration plan was completed in 2000 and is now waiting to be adopted.

5. Multi-User Disposal Site (MUDS). The District in cooperation with EPA, Washington State Department of Ecology, Washington State Department of Natural Resources, and Washington Public Ports Association are jointly evaluating the potential for developing a multi-user disposal site for contaminated sediments. During F Y 1999, the Programmatic EIS was completed. The EIS concluded that: 1) there is a need for disposal of contaminated sediment from Puget Sound, 2) there are a number technically feasible ways to confine contaminated sediments, 3) treatment appears promising but needs to be demonstrated on a large scale, 4) there are a number of management barriers, like liability, that need to be overcome before developing a site, and 5) central Puget Sound has the greatest need. In August 2001, a determination was made by the interagency study team that the further effort to site and construct a MUDS facility be curtailed in favor of developing an agreement with an existing private-sector solid waste landfill

operator. Contaminated sediment disposal capacity at existing solid waste landfills has been found to be immediately available at a reasonable cost, subject to establishment of a long-term interlocal agreement with one or more solid waste landfill operators.

6. Bear Creek 1135 Project. This project will modify a flume-like channel that was dredged as part of the original Sammamish River flood control project. Meanders and riparian habitat will be restored. Large woody debris will be added to reduce velocities and provide holding and rearing habitat for adult and juvenile salmon. Water temperature and velocity considerations are paramount in the design of this project. PDA is near to completion and construction is scheduled for 2003.

7. Green Duwamish General Investigation. This project was authorized in the Water Resource Development Act of 2000 and is currently in the Planning Engineering and Design Phase. Construction of these projects could be initiated as early as 2003.

8. Stillaguamish General Investigation. This project examined existing water quality, vegetation, fish and wildlife data to determine the limiting factors to fish and wildlife population health. The feasibility study was completed in 2000. The project is currently in the plans and specs phase, authorized in WRDA 2000.

9. Old Stillaguamish Section 1135 Project. This project aims to restore estuarine habitat lost due to increased sedimentation in the Old Stillaguamish Channel, improve water quality and increase freshwater flow to the Channel. The project will restore 8 miles of habitat by installing a reverse tidegate structure. The structure will capture fresh water and force it downstream in the Old Stillaguamish Channel thereby improving water quality. The project is currently in the PDA phase, scheduled for construction in September 2002.

10. Wynoochee Dam Section 1135 Fish Restoration Project. Spring flow modifications as well as year-round power generation was investigated. Purpose of the project is to provide adequate fish passage and flow for juveniles; it will also allow additional flexibility in adult passage. The project Modification Report and Environmental Assessment was approved in July 1998. Currently, the project cooperation agreement is being negotiated with the local sponsor.

11. Howard Hanson Dam Additional Water Storage Project. R2 Resource Consultants completed a final report on the third year of monitoring juvenile salmon habitat use of side-channels in the Green River. The report was entitled: Juvenile Salmonid Use of Lateral Stream Habitats in the Middle Green River, Washington. R2 Resource Consultants completed a survey for bull trout immediately below the dam and the first year of a long-term monitoring plan for mainstem river habitat below the dam. Reports will be prepared in 2002. R2 also conducted a research project studying juvenile salmon behavior in a scale-model of a planned fish passage facility for the dam. Tetratech completed a draft report on a Hydrological

Engineering Management Plan for studying and modeling sediment transport in the Green River basin.

12. Bellingham Pilot Project. Seattle District in cooperation with the Environmental Protection Agency, the Puget Sound Water Quality Action Team and the State of Washington Departments of Wildlife and Fisheries, Ecology, Natural Resources and Transportation, have entered into a cooperative relationship with the Port of Bellingham, City of Bellingham, Whatcom County Department of Health, Lummi Tribe and the Nooksack Tribe to facilitate comprehensive contaminated sediment cleanup in Bellingham Bay. This process has been ongoing since September 1996, and has resulted in a comprehensive strategy for sediment cleanup, habitat restoration, source control and long-range aquatic use planning. The comprehensive strategy included several near-term cleanup alternatives that were evaluated in the June 1999 Draft State Environmental Policy Act (SEPA) Environmental Impact Statement. Cleanup will be accomplished in accordance with Consent Decrees and Cleanup Action Plans under the State's Model Toxic Control Act (MTCA). Under MTCA, Georgia-Pacific West, Port of Bellingham, City of Bellingham and Washington Department of Natural Resources.

13. Lower Columbia River Dredged Material Evaluation Framework. This interagency team includes representatives from Seattle District, Portland District, Northwestern Division, Washington Departments of Ecology and Natural Resources, EPA Region 10 and the Oregon Department of Environmental Quality. The team has developed a regional manual for the evaluation of dredged material intended for disposal in the aquatic environment. A full public interest review was completed, and the agency heads signed the final document in November 1998. The committee continues to meet to address new issues and concerns.

14. East Waterway Navigation Improvements. Section 356 of the Water Resources Development Act (WRDA) 96 directed the Corps of Engineers to a) expedite review of potential deepening of the channel in the East Waterway (Duwamish River) from Elliott Bay to Terminal 25 to a depth of up to 51 feet, and b) if determined to be feasible, implement such deepening as part of the project maintenance. This is a significant action under NEPA and SEPA because of contaminated sediments, and requires an EIS. The District and the Port have each contracted several consultant firms to obtain ecological baseline information for the Federal/State EIS. The Biological evaluations have been completed. The largest contract was with SAIC to biologically and chemically evaluate the sediments. Stage I was completed in February 2000 and the Stage II Evaluation study are in progress.

15. Green River Habitat Conservation Plan. The District is participating in the City of Tacoma's drafting of a Habitat Conservation Plan (HCP) for all water supply-related activities on the Green River. This HCP is distinct and unlike the Cedar River HCP for two reasons. First, the City of Tacoma has already negotiated for and reached agreement on minimum instream flows on the Green River. Second,

Tacoma is a sponsor of the Howard Hanson Dam (HHD) Additional water Storage Project and the HHD Section 1135 project. Both projects seek to improve current operation of HHD for protection and restoration of instream resources. Like the Cedar River HCP, Federal, State and Tribal staffs are parties to the Green River HCP. The Corps is providing input to the HCP in ensures consistency with the ongoing HHD reservoir operation and the new planning projects. The draft HCP and EIS was distributed for public review during winter FY 2000.

16. Lake Washington Ship Canal, Section 1135. Construction was completed in May 2000. The strobe lights, which were faulty were re-installed in November 2001. The lights will be tested this winter and accepted in April if functioning. Installation of 6 variable speed monitors to slow fill rate in the large locks is scheduled for FY 2003. Removal of barnacles in the lock filling culverts was performed in FY 2001. Post construction monitoring occurred in 2000 and 2001.

17. Lake Washington Ship Canal Strobe Light Guidance Study. This study began in FY 1998 and evaluated strobe lights as a means to guide juvenile salmon and steelhead away from the large lock filling culverts. A draft report was completed in FY 1999 and distributed for review by the Lake Washington Ecological Studies Group and Waterways Experiment Station. Results showed a 90% reduction in fish density when strobe lights were on during filling of the lock chamber. Study results were incorporated in the LWSC Sec. 1135 project and were shared with other resource agencies at the Columbia River Anadromous Fisheries Evaluation Program review for potential application on the Columbia River. Due to technical problems with the bulbs, the strobe lights where not functional in FY 2000 but will be fixed for the spring of FY 2002.

18. Lummi Section 103 Rock Revetment Project. As mitigation for the revetment project, District staff worked with the Lummi Indian Tribe to construct a 600-ft channel for providing juvenile salmonid passage into a shallow freshwater pond. Riparian plantings are planned to reduce erosion along the excavated banks. Construction was completed in 1999 and the project is currently being monitored.

19. Union Slough 1135. This project will restore tidal inundation to 40 acres on Smith Island in the Snohomish River Estuary, Snohomish County, Washington. This project was constructed in 2001.

20. Lake Washington General Investigation Study. In July 25 to August 25, 2000 the H&H section and Hiram Chittenden Locks performed a study to determine if spilling, salt water barrier operation, saltwater drain operations, and large lockages can effect dissolved oxygen, salinity, conductivity, and temperature upstream of the locks. This data is being used to assess water quality impacts on adult chinook salmon that hold in the area immediately upstream of the large lock.

21. Program Management Plan for the Columbia River. The Seattle District, Walla Walla District, Portland District and Portland division office have been working

together to develop a Program Management Plan for the mainstem of the Columbia River. The primary water quality characteristics being evaluated are temperature and total dissolved gas.

22. Upper Columbia Alternative Flood Control and Fish Operations EIS. Seattle District began an environmental Impact Statement process to address the USFWS and NMFS Biological Opinion measures calling for the VARQ flood control operation at Libby, Hungry Horse and Grand Coulee dams. This is to better provide for reservoir refill at Libby and Hungry Horse, and to provide better assurance of flow augmentation for listed sturgeon bull trout, salmon and steelhead.

23. Cedar River Section 206 Project. This project aims to restore historic floodplain habitat on the Cedar River by breaching the Ricardi levee. The project is beginning the PDA phase and is scheduled for construction in 2003.

24. Seahurst Park Restoration Project. This project will aid in restoring the shoreline process by removing a seawall, beach nourishment and creating an estuarine area. The project is in the PDA phase, scheduled to construct in 2002.

2.10.4. Walla Walla District

1. Six multiple level thermister buoys were installed in Mcnary Dam forebay. Temperature data is being logged hourly at multiple depths. This data was downloaded and utilized in a contracted study in 2001 that documented temperature differences in fish collection channels. In that study flow inducers were used with objectives of reducing thermal gradients.

2. Duplicate wastewater samples were analyzed in the district lab for independent quality control checks of contracted lab analysis. The Little Goose wastewater plant was evaluated for food (mg/kg solid) to microorganism (micro plate count) ratio. An increase was necessary to adjust to balance and uniformity of the loading. The end goal was to produce better water quality of the effluents and reduce solids in the waste stream.

2.11. Personnel and Training

2.11.1. Personnel

2.11.1.1. Division Office

In CENWD-NP--ET-WR, Ruth Abney, hydrologic technician, continued to be deeply involved in TDG monitoring, including data screening, corrections, analysis, Internet homepage posting and dissemination, and reporting. Nancy Yun, hydraulic engineer, continued to refine the necessary procedures for quickly and easily extracting data from the HEC-DSS Data Storage System, coordinate preparation of various graphs needed for annual reports, and operate and maintain water quality models.

Other Corps staff involved in data collection, retrieval and dissemination included:

- ✓ Jim Versteeg, CENWD-NP-ET-WH
- ✓ Rick Delaney, CENWD-NP-ET-WH
- ✓ Debra Petersen, CENWP-IM

2.11.1.2. Portland District

Portland District (CENWP-EC-HR) employed two staff to perform water quality work – one permanent, Jim Britton (biologist) and one term, Kathryn Harris (environmental engineer). Jim Britton is the District water quality specialist. Kathryn Harris maintained the water quality database and participated in environmental restoration planning studies and field data collection. In mid year she transferred to a permanent position in Regulatory. Due to the increased work load related to database maintenance, environmental restoration projects, planning studies, ESA, CWA, and TMDL issues, the HR Section needs two full-time positions.

Other District personnel that occasionally perform water quality related work are Mike Posovich (EC-HR) and George Fong (EC-HR).

Mark Siipola continues as the District's sediment quality coordinator, with Tim Sherman conducting sediment quality evaluation projects and Laura Hamilton managing the District's sediment quality database (SEDQUAL).

2.11.1.3. Seattle District

1. Alicia Austin attended a Bank Restoration Workshop, held at the Seattle District Office.

2. Aimee Kinney and George Hart attended an Environmental Law Workshop, held in Portland, OR.

3. Aimee Kinney attended a course held in Seattle entitled "Understanding the Model Toxics Control Act Amendments".

4. Aimee Kinney attended a Dredging Sediment Assessment and Management workshop.

5. Donald Bisbee attended the "Deep Draft Channel Design for Planners and Economists".

6. Fred Goetz attended the International Conference of large wood in Rivers. He completed a poster presentation on engineered logjams for the Howard Hanson Dam and Green-Duwamish GI studies.

7. Fred Goetz presented three talks at the Lake Washington Chinook Salmon Recovery Workshop.

8. Fred Goetz presented a paper on three restoration projects to the Society of American Military Engineers at the Seattle District.

9. Fred Goetz hosted a presentation by WES and independent scientists on computational fluid dynamics and modeling fish behavior at Dams.

2.11.1.4. Walla Walla District

In NWW, two (GS-11) Limnologists conducted water and sediment quality sampling and laboratory analyses. Drinking water and wastewater analysis was also conducted at two lock and dam facilities. The Hydrology section chief (GM-13) provided leadership/oversight. Project employees conducted project swim beach and drinking water quality monitoring. The Operations Division section staff consists of 1 GS-12 Ergo Compliance Coordinator providing part time coordination and programmatic planning. The two GS-11 Limnologists are the only personnel in the district assigned permanent water quality duties.

2.11.2. Training

2.11.2.1. Division Office

2.11.2.2. Portland District

1. Jim Britton attended Hydrologic Engineering for Planning at HEC in Davis, CA in February.

2. Jim Britton attended SYSTDG training in Portland in March.

3. Laura Hamilton attended Introduction and Advanced ArcView, October 25-29, 2000.

4. Tim Sherman and Mark Siipola attended Contaminated Sediments Seminar, October 29, 2000.

5. Tim Sherman and Mark Siipola attended DOER Conference, 6-8 March 2001.

6. Tim Sherman and Mark Siipola attended SMARM Seminar, May 8, 2001.

7. Tim Sherman and Mark Siipola attended Annual Portland District Dredging Meeting, May 4,2001

8. Tim Sherman attended Contaminated Sediments Seminar, September 21, 2001.

9. Mark Siipola attended Bioaccumulation Workshop in New Orleans February 2001.

10. Mark Siipola attended Contaminated Sediments Seminar, September 21, 2001.

2.11.2.3. Walla Walla District

1. Phillip Fishella received education credits for completion of programs in Operation of Wastewater Treatment Plants.

2. Russ Heaton and Phil Fishella attended Quality Analysis, Quality Control Screening of Laboratory Analytical Data for Environmental Professionals in Seattle, Washington.

2.12. Contract Work

The Regional office awarded no contracts in 2000. A detailed listing of the contract costs follows.

Table 7. Water Quality Contracts Awarded in 2001

12.1 Division Office (CENWD-NP-ET-WR)	Amount ($)
Region's Total	0
12.2 Portland District	
WATER QUALITY	
1. John Salinas, The Cascade Research Group, Murphy OR; water quality monitoring of Lost Creek and Applegate Lakes, Rogue River Basin, OR	44,982
2. Dave Canoy, Environmental Testing, (ET) Salem, OR; Hydrolab profiles of Green Peter/Foster, Detroit/Big Cliff, Lookout Point , and Hills Creek	2,500
3. Dave Canoy, Environmental Testing, Salem, OR; Temperature monitoring in Mckenzie River.	2,550
4. Jim Sweet, Aquatic Analysts, Portland, Oregon; water quality and limnological monitoring of Willow Creek lake and dam-seepage waters, Willow Creek Lake Project, Oregon.	67,540
5. USFS water quality monitoring at Cougar Lake	5,824
6. Miscellaneous equipment purchases	658
7. USGS: TDG monitoring in lower Columbia River.	177,100
8. Forest Science Laboratory, OSU – nutrient analyses – Willow Creek Reservoir.	22,600
9. FMP Real Estate Lease – The Fishery - Warrendale, OR	1,200
10. EWEB, water quality monitoring McKenzie River below Cougar/Blue River	2,000
11. Doug Larson – Sediment Retention Structure data file production & evaluation	7,000
12. Oregon Department Environmental Quality (DEQ) Planning Assistance to States funding for Willamette River modeling to develop temperature TMDL	100,000
13. FMS equipment - Hydrolab Mini-sondes	8,805

14. STENNIS. FMS equipment rental DCP	9,984
15. Columbia Basin Environmental (CBE), measure TDG below Bonneville during spill for fish hatchery release in March	1,920
16. CBE, Lower Columbia River Projects forebay gas monitoring sites evaluation according to RPA 132 of the Columbia River BiOP	14,000
17. CBE, Monitor water quality in the Willamette River during low flow, drought conditions	20,873
18. CBE, monitor gas levels below Bonneville during spill for fish release in May through June	1,370
19. USGS, install and maintain water quality equipment in gages above & below Cougar Reservoir	69,400
20. Waterways Experiment Station (WES), analyze ability of new selective withdrawal design at Cougar to meet downstream target temperatures.	7,000
WATER QUALITY SUBTOTAL	567,306
USGS GAGING STATION CONTRACTS DETAILS	
NUMBER - LOCATION	
14252580 Toutle River, Twr Road, Nr Silver Lake, Wa	35,000
14330000 Rogue River Blw Prospect, Or	3,780
14335075 Rogue River At Mcleod, Or	14,500
14337500 Big Butte Creek Nr Mcleod, Or	14,500
14337600 Rogue River Nr Mcleod, Or	3,780
14337830 Elk Creek Nr Cascade Gorge, Or	14,500
14337800 Elk Creek Blw Alco Creek, Or	22,500
14337870 West Branch Elk Cr Nr Trail, Or	3,780
14338000 Elk Creek Nr Trail, Or	14,500
14338100 Rogue River At Trail, Or	14,500
14339000 Rogue River At Dodg Br Nr Egl Pt, Or	14,500
14359000 Rogue River At Raygold, Or	3,780
14362000 Applegate River Nr Copper, Or	3,780

14366000 Applegate River Nr Applegate, Or	3,780
14369500 Applegate River Nr Wilderville, Or	3,780
USGS GAGING STATIONS SUBTOTAL	170,960
TOTAL WATER QUALITY	738,266
SEDIMENT QUALITY	
SEDIMENT QUALITY & ODMDS EVALUATIONS	
1. Sound Analytical Services – Umpqua River and Winchester Bay, Sediment analyses	10,261
2. Sound Analytical Services –Skipanon Channel and Boat Basin, Sediment analyses.	8,831
3. Sound Analytical Services – Oregon Slough, VANALCO and CRCD #76, Sediment analyses.	18,713
4. Sound Analytical Services – Astoria EBB P-3, Sediment analyses	7,600
5. Sound Analytical Services – Springfield Mill Pond, Sediment analyses	1,383
6. Sound Analytical Services – Willamette Mission State Park	2,748
7. Sound Analytical Services – Siuslaw River, Sediment analyses	3,456
8. Sound Analytical Services – Chetco River, Sediment analyses	4,299
9. Sound Analytical Services – Coquille River, Sediment analyses	3,326
10. Hart Crowser, Inc. Willamette River Reference Site Project – Total $119,630	66,993
11. G & L Sablefish, Inc. - Boat & operator, Siuslaw River, and Umpqua River, Sediment sampling.	4,182
12. Marine Sampling Services – Boat crew and sampling equip, Oregon Slough, VANALCO, CRCD #76, Astoria EBB P-3, Sediment sampling.	31,250
13. John Vlastelicia – Boat & Operator , Skipanon, Sediment sampling.	1,610
14. Sediment Trend Analysis-MCR ODMDS study	259,845
15. Sidescan Sonar/Sediment Acoustic Characterization	31,432
16. Hydrosurvey Boat and Crew	29,125
17. Sidescan Sonar Yaquina Bay	35,231
18. Benthic Infauna Evaluation Yaquina Bay	49,600
NWP SEDIMENT QUALITY SUBTOTAL	569,885
TOTAL PORTLAND DISTRICT	1,308,151
12.3 Seattle District	
1. Jones and Stokes: Cedar River Gravel	$74,000
2. SAIC: 2001 Sediment Management Annual Review Meeting minutes	$4,500

3. HTI: Fish Passage at the Hiram Chittenden Locks	$220,000
4. U.S. Geological Survey (Montana District): Field water quality data collection/analysis on Lake Koocanusa (3 reservoir stations, 1 Riverine station)	$62,000
5. Common Sensing, Inc. (Clark Fork, ID): Dissolved gas sensor operation and maintenance for Chief Joseph forebay	$4,400
6. Striplin Environmental Associates: Bioaccumulation Work Group Tech. Support	$27,000
7. R2 Resource Consulting: Sammamish River Juvenile Study	$35,000
8. Tetra Tech: Action Plan	$104,000
9. Biosonics: Fish Use of the Saltwater Drain and Spillway at the Hiram Chittenden Locks	$125,000
10. R2 Resource Consultants: Smolt Monitoring in Lake Washington	$60,000
11. WES: Water Quality Study of Hiram Chittenden Locks	$10,000
12. Jones and Stokes: Sammamish River Small Tributaries Study	$40,000
13. Tetra Tech: Skagit River Evaluation Areas	$111,000
14. R2 Resource Consultants and ERS collected water quality data and sampled juvenile fish abundance in side channel habitats of the Green River and Sammamish River.	$55,000
15. R2 Resource Consultants collected fish habitat data in the mainstem of the Green River.	$60,000
16. R2 Resource Consultants surveyed the mainstem Green River below Howard Hanson Dam for bull trout.	$17,000
17. R2 Resource Consultants built and operated a scale model of a fish passage facility planned for Howard Hanson Dam. Data was taken on juvenile salmon behavior and downward flow fields.	$45,000
18. Mevatec evaluated smolt entrainment of the Large Lock filling culverts using hydroacoustics.	$80,000
TOTAL NWS DISTRICT with sediment water quality	$1,133,900
Total without sediment quality:	$1,102,400
12.4 Walla Walla District	
1. HDR Engineering was awarded a contract to install the six instrumentation bouys in the McNary fore bay ($45,000).	$45,000
2. Various local laboratories were awarded purchase orders to perform some of the swim beach, drinking water and wastewater analysis ($12,000).	$12,000
3. HDR Engineering was awarded a contract to perform routine maintenance on TDGMS systems ($215,000)	$215,000

2.13. Meetings and Conferences

2.13.1. Regional Office

1. Water Quality Team staff (Richard Cassidy, Nancy Yun and Ruth Abney) attended numerous in-house, public, and inter-agency meetings in conjunction with the implementation of the spill for-fish-passage and fish flow augmentation measures requested by NMFS. Meetings were held with National Marine Fisheries Service, US Fish and Wildlife Service, Bureau of Reclamation, Bonneville Power Administration, Power Planning Council, State Environmental Departments, Indian tribes, and others. Most of the attendance has been at the weekly meetings of the regional Technical Management Team discussing weekly flow augmentation operations for fish during April-August 1998. Attendance at NMFS's Water Quality Team meetings was also quite frequent.

2. Water Quality Team staff attended numerous regional meetings concerning TMDL generation and implementation.

3. Mr. Richard Cassidy attended the US-Canada Transboundary Gas Group meeting in Vancouver, BC, Canada on October 12, 2000. He made a presentation on the 2000 spill season at the mainstem Columbia and Snake projects.

2.13.2. Portland District

1. Jim Britton and Kathryn Harris attended several water quality database adoption meetings along with representatives from other Action Agencies.

2. Jim Britton attended Cougar Selective Withdrawal Environmental Coordination Committee meetings.

3. Jim Britton attended numerous Water Quality Team (WQT), TDG Subgroup, and Trans Boundary Gas Group (TGG) meetings throughout the year.

4. Water quality staff attended meetings at NWD and NWW regarding developing the Water Quality Plan required by RPAs in the Columbia River BiOP prepared by NMFS.

5. Water quality staff attended coordination meetings at DEQ as part of the Planning Assistance to States (PAS) Program. PAS funding was used to help Oregon DEQ in their Willamette River temperature TMDL modeling effort.

6. Water quality staff attended the H&H conference held at NWD in May. The conference acquainted all the Districts in their operations, staffing, problems, et cetera.

7. Jim Britton attended DEQ Willamette River modeling (CE-QUAL-W2) advisory group meetings.

8. Jim Britton presented the findings of the Cougar Reservoir water quality study to representatives of Eugene Water & Electric Board (EWEB) in March.

9. Water quality staff participated in several meetings involving resource and action agencies dealing with TDG and temperature TMDLs being developed by the states of Oregon and Washington and the EPA

10. Tim Sherman and Mark Siipola attended a contaminated sediments seminar sponsored by The Oregon Law Institute, October 29,2000 and September 21, 2001.

11. Tim Sherman and Mark Siipola attended, DOER Conference, March 6-8, 2001.

12. Tim Sherman, Mark Siipola and Laura Hamilton attended SMARM Seminar May 8, 2001, Seattle District Corps.

13. Tim Sherman and Mark Siipola attended Annual Portland District Dredging Meeting, May 4, 2001.

2.13.3. Seattle District

1. David van Rijn, Marian Valentine and Layna Goodman participated in various Program Management Plan meetings in Portland.

2. Marian Valentine, David Van Rijn and Amy Reese conducted and informational workshop to discuss the need for a saltwater waiver for the Lake Washington Ship Canal.

3. Amy Reese and Marian Valentine participated in monthly Instream Flow Commission meetings for the Cedar River HCP.

4. As a new member of the Water Quality Team, Wayne Wagner participated in many meetings with this group.

5. Marian Valentine and Layna Goodman attended many meetings regarding Washington State's Triennial Review of the Water Quality Standards.

6. Layna Goodman, Marian Valentine, Linda Smith and Amy Reese attended two meetings with the Lake Union Action Team.

7. Dave Kendall attended and presented an overview of Dredged Material Management Program (DMMP) bioaccumulation testing at the COE/EPA Bioaccumulation Working Group and Sediment Experts Meeting. New Orleans, LA, (20-22 February, 2001)

8. Dave Kendall attended a Contaminated Sediments Management Workshop, Seattle, WA (25-26 April, 2001).

9. Dave Kendall gave a briefing on the DMMP Interagency Process to the International Navigation Association (PIANC) Dredging Subcommittee Workgroup, Seattle, WA (June 2001).

10. Jeff Laufle, ERS, attended the *Salvelinus confluentus* (bull trout) Curiosity Society workshop in Leavenworth, WA, 5-7 September 2001.

11. Bernie Hargrave continued to participate with approximately 40 local, regional and federal government entities on the Lake Tapps Task Force, investigating issues relating to this private hydropower reservoir.

12. Alicia Austin attended the Center for Streamside Studies, Water Resources Convention.

13. Alicia Austin attended a Volunteer Monitoring Convention.

14. Marian Valentine, Layna Goodman and Dave van Rijn attended the Hydraulics and Hydrology conference in Portland. The conference held a special session dealing with water quality issues.

15. Marian Valentine, Wayne Wagner and Layna Goodman attended numerous conferences and meetings dealing with Total Maximum Daily Load (TMDL) process for temperature and TDG on the Columbia River.

16. Stephanie Sterling attended the Western Dredging Association (WEDA) conference, Houston, TX June 2001

17. Stephanie Sterling attended a Risk Communication Workshop, March 2001.

18. Stephanie Sterling attended Society for Environmental Toxicology and Chemistry meeting in November, 2000.

19. Stephanie Sterling attended a National Dredging Team Meeting in January 2001.

2.13.4. Walla Walla District

NWW District water quality personnel were involved in the following:

6 February 01: Annual Dissolved Gas Meeting in Portland
1 March 01: TMDL workshop in Portland
18 May 01: TMDL meeting in Idaho
29 May01: TMDL conference call

2.14. Future Water Quality Objectives/Reports

2.14.1. Regional Office

1. Continue to coordinate and monitor the Corps annual total dissolved gas monitoring program;

2. Continue to monitor and adjust spill levels at Corps projects during the spill season to maintain TDG levels below the state standards of 115% in the forebays and 120% in the tailraces;

3. Continue to develop, maintain and operate an active homepage for real-time use in water management of the Columbia River reservoir system,

4. Continue to improve modeling capability;

5. Continue to improve Division-District coordination on water quality and related issues

6. Continue to provide the required level of oversight to the Dissolved Gas Abatement Study team; and to represent the Division at regional forums dealing with compliance issues involving total dissolved gas and other water quality parameters, and

7. Provide water quality and general environmental modeling support to others as needed.

8. Work with HQ to resolve state water quality variance issues.

9. Develop an inter-agency Water Quality Plan for the Columbia/Snake system.

10. Participate in TMDL development for TDG and water temperature on the Columbia/Snake mainstems.

11. Participate in the development of a CENWD – North Pacific Water Quality Team to provide regional program management guidance.

12. Develop and implement 1-year and 5-year Water Quality Plans as specified in the 2000 NMFS BiOp.

13. Participate with BPA and BOR in water temperature and TDG modeling as specified in the 2000 NMFS BiOp.

2.14.2. Portland District

WATER QUALITY

1. Develop problem-specific water quality studies for Lost Creek & Applegate Lakes in the Rogue basin, and at Willow Creek Lake, Heppner, Oregon.

2. Continue to operate and maintain stream-gaging programs in the Willamette and Rogue River Basins, Oregon, Willow Creek basin, and in Toutle River basin, Washington, and in the Lower Columbia River main stem. Upgrade some of the Willamette gages to obtain temperature data to support DEQ TMDL modeling efforts.

1. Work with Oregon resource agencies to develop instream-flow rules for the Willamette River requiring the Corps of Engineers to provide specific flows year-round for fisheries and water quality enhancement.

2. Continue coordination with resource agencies to assure Portland District's compliance with Federal and State water quality regulations at existing and proposed Federal projects.

3. Continue studies of mercury contamination in Cottage Grove and Dorena Reservoirs.

4. Continue selective withdrawal at Willow Creek Reservoir to aid locals in reducing temperatures in Willow Creek below the project.

5. Review historic and current data to determine problem specific water quality studies to conduct at Corps projects.

6. Continue to implement the District Fixed Monitoring Program (FMP) for monitoring TDG below Corps Projects in the lower Columbia River. Evaluate the need for dropping and/or moving FMP sites to improve the programs goal of monitoring compliance with water quality standards.

7. Continue to monitor TDG below Corps Projects in the Willamette and Rogue Basin on an as-needed basis.

8. Continue to participate with the U.S.F.S. and the city of Salem as a team member to monitor water quality in the North Santiam Watershed.

9. Implement plans and specifications for water quality monitoring during construction of the Selective Withdrawal Tower at Cougar Reservoir and Blue River Reservoir.

10. Continue to support efforts to set up water quality models of District Projects that have important water quality problems.

11. Support the State and EPA in developing TMDLs for the Willamette and Columbia River.

12. Continue participation in developing a Water Quality Plan for District projects in the Lower Columbia River as required in the NMFS Biological Opinion on saving threatened fish species.

SEDIMENT QUALITY

1. Continue the District-wide sediment quality evaluation program at Operations and Maintenance dredging projects During FY 2002, sediment quality evaluations are scheduled in the Columbia River (Baker Bay and Chinook Channel), Port Orford, Rogue River, In Lieu Fishing Treaty Sites, Bradford Island Fish Ladder Project, with possible return to sample Skipanon and Chetco Projects.

2. Continue coordination with resource agencies to assure Portland District's compliance with Federal and State water quality regulations at existing and proposed Federal navigation projects.

3. Additionally, advise the Regulatory and Environmental Resource Branch (CENWP-EC-R) on testing procedures and interpretation of results for Section 404/103 permit actions.

4. Continue to develop and update management/monitoring plans and implement the management/monitoring programs for ODMDSs.

5. Continue to participate in development of regional dredging teams as defined in the December 1994 MARAD report.

6. Continue to updating and implementation of the Columbia River Dredged Material Evaluation framework for sediment quality evaluation.

7. Complete Section 103 selection documentation for new disposal sites at MCR.

8. Conduct biological baseline studies at the MCR Deep Water Site.

9. Conduct biological infauna studies at Yaquina Bay ODMDSs.

2.14.3. Seattle District

Continue maintenance and updates to the Dredged Analysis Information System (DAIS).

Continue development and application of an operational water temperature model for Libby Dam to aid in determining the effects of Kootenai River white sturgeon flows (as required by the Endangered Species Act).

Continue to develop and implement a total dissolved gas-monitoring program for Libby Dam and the Kootenai River in the event of spill.

Continue automating data collection capabilities with emphasis on the Lake Washington Ship Canal.

Continue coordination with other federal, state, and local agencies involved in water quality programs, on all project planning, construction and operating efforts.

Insure that water quality assessment and water quality goals are included in watershed evaluations conducted by the District.

Continue development and application of a predictive model of salinity intrusion for the Lake Washington Ship Canal.

Continue the sediment-monitoring program at HHD as part of the drawdown of the turbidity pool.

Continue interagency discussion to develop solutions to dissolved gas problems above and below Chief Joseph Dam.

Continue to evaluate the possibility of installing at least one new generating unit or other means at Libby Dam to allow high flows with reduced risk of spill and high TDG levels.

Conduct spill tests at Libby and Albeni Falls Dams for the purposes of determining what levels of total dissolved gas result from various quantities of spill..

Continue to assess the impacts of the proposed test pool at Howard Hanson Dam.

In cooperation with Biosonics, Inc., Seattle District personnel are conducting a study on the horizontal and vertical distribution of salmon smolts in the lower Lake Washington Ship Canal. Contour plots of fish abundance were completed in 1999 and 2000.. A final report is scheduled for early 2002.

Initiate design of a replacement fish passage facility associated with Mud Mountain Dam, White River, WA.

Conduct acoustic tag study to determine smolt use and behavior in the estuarine environment downstream of the Locks. In addition, information of smolt passage such as routes through the locks and timing may be obtained.

SAIC will conduct a study to photograph the subtidal habitat and collect fish and crab data at Quillayute. The report is scheduled for completion in January 2003.

Seattle District will conduct a study to determine fish usage of the Corps designed fish gap at Neah Bay.

2.14.4. Walla Walla District

Important Objectives Carried Over From FY01

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Objective 1. Finalize the district potable water program that encompasses procedures and contacts for all operation and emergency situations. The program will include training systems and test / evaluation programs. A final work product of this effort will be to document the outline of this program.

Objective 2. Finalize development of the district sanitary system program similar to program in objective number one.

Objective 3. Identify existing facilities that need coverage under the Clean Water Act (CWA) and the Safe Drinking Water Act (SDWA) and compliance status. Plan for corrective actions and develop budgets specifically to correct the problems. Also determine necessary permits and operations to comply with Phase II NPDES and WRDA 96.

Objective 4. Identify personnel needs required to monitor and operate district water plants and wastewater plants.

Objective 5. Hire and train required personnel to satisfy compliance with the SDWA and CWA.

Objective 6. Complete a multi-year evaluation of swim beach monitoring program, evaluate training, equipment, and evaluate trends. Produce a report outlining the current status.

<u>New Water Quality Objectives for FY02</u>

Objective 7. Pursuant to the Interagency Draft Water Plan for Compliance with the CWA (dated 21 September 2001), evaluate requirements necessary for compliance monitoring of CWA section 303(D) listing of the following:

- Snake River from confluence with the Columbia (RM324.3) to the confluence with the Palouse River (RM59.3) for dissolved oxygen.
- Snake River from the Washington Boarder with Oregon to the Salmon River for mercury.
- Columbia River at McNary to the confluence with the Yakima River for bioassay.
- Lower Snake River from the confluence with the Columbia to the confluence with the Salmon River for temperature.
- Snake River from the confluence with the Columbia to the confluence with the Clearwater River for total dissolved gas.
- Lower Snake River (unspecified) for pH.

Objective 8. Pursuant to RPA-5 of the 2000 FCRPS Biological Opinion (dated 21 September 2000), provide technical assistance to Mr. Rick Emmert for the implementation of his one and five year plans for Walla Walla District Projects.

Additionally provide technical assistance in completion of his annual performance report specified in RPA-13.

Objective 9. Pursuant to RPA-33 and 34 of the 2000 FCRPS Biological Opinion (dated 21 September 2000), provide technical assistance to Mr. Rick Emmert for the installation a temperature monitoring system for facilitating accurate measurements from elevation and for the adjustment of the temperature control structures present and future to mitigate downstream temperature effects.

Objective 10. Pursuant to RPA-114 and 115 of the 2000 FCRPS Biological Opinion (dated 21 September 2000), provide technical assistance to Mr. Rick Emmert for the comprehensive investigation of depth and temperature in the fish passage systems and the project near field to determine potential passage problems and facilitate other model and temperature investigation efforts. Additionally, in conjunction with other studies use economy of force operations to maximize cost benefit to all water quality studies present and future. Additionally, the feasibility of replacing old style mercury tubes with improved accuracy platinum RTDs coupled incorporated into TDGMS to insure a cyclic frequency will be evaluated.

Objective 11. Pursuant to RPA-131 and 132 of the 2000 FCRPS Biological Opinion (dated 21 September 2000), provide technical assistance to Mr. Rick Emmert for the comprehensive review of the dissolved gas monitoring stations in the Walla Walla District and provide recommendations for implementation of remedial actions. Special attention will be given to correcting thermocline related problems associated with the forebay monitors. The district will continue to operate the TDGMS to provide the region with the highest quality data obtainable within the annual O&M budgeted appropriation line item.

Objective 12. Pursuant to RPA-139 of the 2000 FCRPS Biological Opinion (dated 21 September 2000), provide technical assistance to Mr. Rick Emmert with good science practices to evaluate gas abatement options at Dworshak Dam.

Objective 13. Pursuant to RPA-143 of the 2000 FCRPS Biological Opinion (dated 21 September 2000), provide technical assistance to Mr. Rick Emmert with quality temperature monitoring data for use in all present and future modeling studies. In addition all data collection efforts will be conducted under a peer reviewed SAP, and undergo a rigorous QA/QC procedure to optimize its usefulness to all interested parties.

Objective 14. If requested by the appropriate authority redundant TDGMS installations will occur in FY02 given favorable hydrologic conditions for installation as determined by the Chief of H&H Branch. This is a level two objective since there is no statutory requirement.

3. Specific Project Information

3.1. Portland District

3.1.1. Rogue River Projects/Lost Creek Lake-Applegate Lake Water Quality

a. Summary. John Salinas, The Cascade Research Group, collects monthly secchi, nutrient, phyto/zooplankton and hydrolab profiles at Lost Creek and Applegate Lakes from April through November. This work continued through November of 2001. Temperature data collected downstream of the dam are used throughout the summer and fall drawdown period to estimate the week-to-week availability of "cool" water stored in the impoundments. Based on these estimates, "cool" water is apportioned in releases during this critical period, thereby maintaining release-flow temperatures required for fisheries protection and enhancement.

b. Proposed Activities. A new water quality monitoring plan will be developed for 2002. The plan will address specific water quality problems at the reservoirs. The water quality model CE-QUAL-W2 was set up for Lost Creek and will be further refined to assist the District in achieving target temperatures and in predicting water quality.

3.1.2. Rogue River Projects/Elk Creek Turbidity

a. Summary. A limited turbidity monitoring program was continued at the Elk Creek dam site. The objective was to assess the impact of dam construction on Rogue River water quality, and to obtain data for use in the verification of a numerical model. Turbidity data are collected hourly at four stream gauging stations, which are operated and maintained by the USGS under contract with the Portland District.
The history and monitoring capabilities of each of these stations are as follows:

ID/STREAM/LOCATION/PARAMETERS/INITIATION YEAR

14338000/Elk-Creek-NR-Trail/TEMP-TURB-TEMP/June 1973

14337800/Elk-Creek-NR-Cascade-George/TEMP-TURB-TEMP/Aug 1973

14337830/Elk-Creek-Below-Alco-Creek/TEMP-TURB/May 1986

14338100/Rogue-Riv-Below-Trail/TEMP-TURB/May 1988

Also selected as a turbidity monitoring site was a stream-gaging station located on West Branch Elk Creek (USGS Gage Number 14337870). Stream discharge and temperature data have been collected at this site since October 1973 and August 1977, respectively. As directed, the USGS installed a turbidimeter at this station, but was not able to supply the equipment with electrical power. Thus, the station was excluded from the turbidity-monitoring network in the Elk Creek drainage basin.

In 1988, the turbidimeter at Station 14338000 (Elk Creek near Trail, located 0.4 miles upstream of Elk Creek's confluence with the Rogue River) was transferred to a newly constructed USGS gage house located roughly one mile farther upstream near the Elk Creek dam site

b. Proposed Activities. Work will continue in 2001.

3.1.3. Willow Creek Lake Project

a. Summary. Aquatic Analysts, Portland, and Dr. Marvin Lilley, University of Washington, continued with water quality and limnological studies at Willow Creek Lake Project in 2001. A total of 8 field trips were made between April and November. In 2002 a new water quality monitoring plan will be developed to address specific problems. Water quality was monitored in the tailwaters of Willow Creek reservoir and downstream within the city limits to assess the effectiveness of selective withdrawal to reduce temperatures. Water temperatures were collected hourly, upstream of the reservoir in Willow Creek and Balm Fork in the headwaters and inflows to the reservoir to provide data for future modeling efforts and for State TMDL considerations.

b. Proposed Activities. Limnological and water quality studies, including research on methane production, will continue in 2002. Of particular interest are the impacts of carbon loading by algae blooms and nutrient loading from the watershed on methane and hydrogen sulfide production in the lake. More intensive water quality monitoring of nutrient loading during spring will occur in 2001 to aid in setting up a water Quality model of the lake (CE-QUAL-W2). Also, to assist locals and help improve downstream conditions, the selective withdrawal structure will release water from deeper in the pool. This should reduce temperatures and improve pH – both of which are too high in Willow Creek immediately below the dam.

3.1.4. Willamette Valley Projects

a. Summary. Most monitoring this year occurred at Cottage Grove, Dorena, Hills Creek, Lookout Point, Cougar, Green Peter and Detroit Reservoirs. To assist Oregon DEQ in its TMDL modeling efforts in the Willamette River, the Corps collected temperature data below Hills Creek, above lookout Point, Green Peter, Dorena, and Cottage Grove Reservoirs. Routine lake profile data (pH, temperature, turbidity, secchi depth, DO, % DO SAT, redox, and TDS) were collected at Detroit, Green Peter, Hills Creek, and Lookout Point. Similar data was collected at Cougar and Blue River reservoirs by the USFS. This data was collected to provide historical data to help in assessing the impacts of construction of the remodeled Selective Withdrawal Tower on water quality. Under contract, CBE collected data at three sites on the Willamette River – Albany, Salem, and Newberg Pool – to help the State monitor the impacts of low flows, resulting from the drought, on water quality.

b. Proposed activities. Spill related TDG concentrations in waters below projects, where fish concerns are paramount, will continue to be measured on a spot basis. Temperature data will continue to be collected above and below projects mentioned in the above paragraph to support DEQ TMDL modeling efforts. Specific water quality problems will

be investigated as the need arises. Water quality models will be set up for Cougar and Blue River reservoirs to aid in the operation of the projects and help the State in developing a temperature TMDL.

3.1.5. Detroit Dam and Reservoir

a. Summary. The Corps, City of Salem, and USFS coordinated efforts to install turbidity monitoring equipment in the tributaries of the reservoir.

b. Proposed Activities. In 2000 the three agencies will continue to monitor turbidity and other water quality parameters.

3.1.6. Columbia River Projects - TDG Fixed Monitor Program (FMP)

a. Summary. Monitoring of TDG concentrations continued in the forebay and tailwater of John Day, The Dalles and Bonneville dams and at Camas below Bonneville to provide real-time data for operations, and time series data for research and modeling efforts through the Fixed Monitoring Program. A study of the representativeness of the Camas Site was conducted by WES. Camas was found to be a good site. Forebay sites at the other projects were evaluated as well. John Day forebay site probably needs to be moved closer to the spillway.

b. Proposed Activities. Continue TDG monitoring at the FMP sites under MIPR to the USGS. A TDG subcommittee recommended adding non-real time sites at Corbett Landing below Bonneville and near the spillway at John Day. The Corbett landing site may provide better data for operations for spill to aid fish passage. The data will be evaluated to determine if this is true. The forebay site at John Day is problematic because of temperature induced fluctuations in gas levels that are not related to spill conditions at McNary. At John Day, as an experiment, an attempt will be made to collect reservoir tap water, at depth, from the piping system in the dam and use this water to measure gas levels. If this proves achievable and successful, then it may be a better way measuring forebay gas concentrations that will avoid the transient temperature-induced gas problems.

3.1.7. Dredged-Material Evaluations for Navigation Projects

3.1.8. Dredged-Material Evaluations for Navigation Projects

a. Summary. Dredged-material evaluations were conducted for sediments at Astoria EBB, Umpqua River and Winchester Bay, Siuslaw River, Springfield Mill Pond, Oregon Slough, VANALCO, CRCD # 76, Chetco River and Boat Basin, Coquille River and Skipanon Channel and Boat Basin.

3.2. Seattle District

3.2.1. Lake Koocanusa (Libby Dam)

a. Summary. There were no significant water quality problems at Libby Dam Project in WY 2001.

Under contract, the U.S. Geological Survey performed water quality monitoring below Libby Dam and at three sites within the reservoir. The monitoring program consists of analyses for nutrients, inorganic compounds, heavy metals, chlorophyll, pH, specific conductivity, dissolved oxygen, nitrogen saturation, and water temperature. These analyses help identify pollution from upstream agricultural, mining, industrial, and municipal sources. They also establish a baseline for identifying similar types of pollution from sources downstream from the project. This data is shared with state and local water quality agencies to assist in that endeavor.

Real-time outflow water temperature data were also transmitted to the Division and District Office by the water control data collection system. Daily temperature records show that the Montana State water quality standard of 19.5^{o}C (67^{o}F) was not exceeded during this water year. The selective withdrawal facilities at the dam allowed the temperature rule curve to be closely followed throughout WY 2001. Monthly dissolved oxygen sampling showed that the Montana State minimum standard of 7.0 mg/l was not exceeded. The Montana State minimum standard of 110% nitrogen saturation was not exceeded in 2001.

A total dissolved gas sensor, which transmits real-time data to the District Office, was added in 1995. This sensor would be deployed when spill for flood control is likely. This sensor has not been deployed since it was added.

Libby Dam operated to meet the flow objectives of the 2000 U.S. Fish and Wildlife Service and National Marine Fisheries Service Biological Opinions. The flow regimes were coordinated through the Columbia River Technical Management Team.

b. Proposed Activities. The Seattle District will work to improve water temperature monitoring in both Lake Koocanusa, and downstream in an effort to meet water temperature criteria set forth by the US Fish and Wildlife Service in their annual guidelines for white sturgeon recovery. The District will continue to work with other federal, state, local, and tribal agencies to coordinate appropriate water quality and flow regimes for the white sturgeon in the spring of 2002. A spill test is planned to be conducted in June of 2002.

3.2.2. Pend Oreille Lake (Albeni Falls Dam)

Summary. The project did not experience any significant water quality problems during 2001.

A combination of divers and suction dredging was continued to a limited extent to remove Eurasian watermilfoil in the Pend Oreille River above Pend Oreille Lake. The extent of the Eurasian milfoil has now spread to Pend Oreille Lake. If the milfoil becomes established in sloughs and wetland areas off the main river channel, it will be effectively impossible to control.

Proposed Activities. A multi-agency group is developing a long-term treatment and monitoring plan. Follow-up monitoring and treatments of milfoil are planned for next year. Spot checks of TDG during spill will also be performed.

3.2.3. Rufus Woods Lake (Chief Joseph Dam)

a. Summary. Dissolved gas and water temperature data was collected via a sensor in the forebay and a sensor in the tailwater. Common Sensing, Inc., based in Clark Fork, Idaho performed sensor maintenance and calibration.

Due to the lack of spill in the Upper Columbia in WY 2001, dissolved gas levels entering Rufus Woods Lake remained below 110%. In other years, the tailwater dissolved gas measurements were complicated by the location of the tailwater sensor on the spillway side of the river. Water from the spillway and powerhouse do not mix fully for several miles downstream of the project. As a result, the tailwater sensor can reported high levels of dissolved gas during periods of spill. A weighted average of spillway and powerhouse flow was used to predict an average value for the river cross-section, should be used to determine gas levels during spill events.

The Columbia River from the Washington-Oregon border to Grand Coulee Dam surface water classification is Class A (Excellent). Based on the downstream sensor temperature records, it appears that the discharge water temperature exceeded the Washington State standard for water temperature of 18^{o}C (64.4^{o}F) from 4 August through 1 October 2000. Chief Joseph Dam does not have selective withdrawal temperature control.

No new permits were issued for net pens in Rufus Woods Lake by NWS, in 2001.

b. Proposed Activities. The District plans to continue dissolved gas abatement for WY 2002.

3.2.4. Lake Washington Ship Canal and Locks

a. Summary. Saltwater intrusion into Lake Washington through the ship canal was prevented in WY 2001. The District continued to collect salinity data from five stations, and installed one new station that automatically transmit hourly data to the Reservoir Control Center through the District's water control data collection system. This real-time data allowed a significant reduction in the field monitoring effort and closer monitoring of advances of the saltwater wedge and enabled more efficient operation of the Locks for conservation and control of saltwater intrusion. Periodic field measurements were made at sampling stations in the canal and Lake Union to ground-truth the automated sensor data.

The spring and summer of 2001 were normal. Spill from the smolt slides continued into July. Salinity intrusion was controlled by a combination of saltwater drain and spill. In the past, mini-flushing proved a valuable tool in removing saltwater from the lock chamber before it entered the ship canal. Evaluation of juvenile salmon migration through the large lock has shown that this technique injures and kills too many juveniles

to be considered as a viable technique for salinity control. Installation of 4 new smolt slides and spill through one spillbay indicates surface spill may be a viable technique.

b. Proposed Activities. The District plans to continue monitoring the network of salinity sensors and to use this data in determining lock operations associated with control of saltwater intrusion. In 1996, District personnel constructed a predictive model of saltwater intrusion into the Lake Washington Ship in order to assess the effects of changes in lock operation. The District plans to continue refinement of this model and to use it to evaluate the efficacy of various water management and saltwater control scenarios. The District will also continue to look at operational effects on water quality upstream of the locks and in the ship canal.

3.2.5. Wynoochee Dam and Lake

a. Summary. The 2000 annual shutdown of the hydroelectric plant for fish outmigration (part of their FERC license) began on 15 April. Discharge was transferred to the multi-level fish passage conduits in the dam for the duration of the shutdown. Hydroelectric plant operations resumed on 1 July.

During the summer stratification period, the intake temperature panel system was used to regulate downstream temperatures during operation of the hydroelectric plant. A normal spring and a late spring storm provide Wynoochee with enough water to refill.

The downstream temperature control point for the Wynoochee Project is the USGS River Gauging Station known as the Wynoochee River at Grisdale Gauge. A sensor at that gauging station reports river temperature on a real-time basis. Manual readings are taken weekly to check calibration of the sensor. In addition to temperature monitoring done at the Grisdale Gauge, there is a sensor monitoring the temperature of the water in the hydroelectric plant tailrace.

Additional water quality monitoring is described below:
Data from the intake temperature string, which transmits real-time temperature data hourly, was plotted weekly as forebay temperature profiles.
From May through October, water quality data was collected from five locations in the river, including inflow to the lake.
In addition, water quality profiles were taken in the reservoir forebay.

b. Proposed Activities. No new activities are currently planned.

3.2.6. Howard A. Hanson Dam and Lake

a. Summary. During WY 2001, water quality problems at Howard A. Hanson dam were limited to occasional high turbidity readings.

The Green River specific surface water classification is Class AA (Extraordinary). Throughout the year, daily water temperature and turbidity values are collected by Tacoma Water Department personnel at their plant intake located a short distance downstream of Howard A. Hanson Dam and by project personnel at the inflow and

outflow sites of the reservoir. Continuous real-time water temperature data are also collected by the Seattle District water control data collection system from the project tailwater monitoring station ¾ mile downstream of the dam. Records show the outflow temperature did not exceeded the Washington State water quality standard of 16^{o}C (60.8^{o}F) during 2001. During a normal water year, turbidity readings in excess of the State standards (5 NTU) are generally of short duration and occur during or immediately following storm events. Because WY 2001 was a drought, exceedences in turbidity did not occur.

During the period of conservation storage (generally June through October), field measurements of the reservoir water quality profiles are taken approximately every three weeks. Depth versus dissolved oxygen, temperature, and specific conductivity measurements are made at seven reservoir stations. In addition, the above parameters are measured upstream of the reservoir and just below the dam. There was little change in the chemical quality of the impounded water throughout the year.

b. Proposed Activities. FY 2001 work includes continue water quality, sediment and total suspended solid monitoring in the reservoir and downstream.

3.2.7. Mud Mountain Dam

a. Summary. Water quality data collection efforts in WY 2001 were limited to daily measurements of temperature and turbidity above and below the reservoir as a guide in regulating release patterns and to comply with State and Federal regulations. Most water quality problems at Mud Mountain Project are related to a high suspended-solids load associated with upstream glacial melt and erosion of sediment accumulations upstream of the project and in the reservoir. During and immediately following high flows and in association with some project maintenance procedures, relatively short-term high turbidity levels will be experienced that will exceed State of Washington water quality standards.

The White River has a natural high sediment load during storm events. During significant storms, a large amount of debris from the upstream watershed may enter the reservoir. While much of the debris is usually collected in upstream areas, some of it may accumulate on the trash-rack. As debris is removed from the trash-rack, the river lowers and can cut channels through accumulated sediment upstream of the dam resulting in higher turbidity during these operations.

b. Proposed Activities. No new activities are currently planned.

3.3. Walla Walla District

Total Dissolved Gas Monitoring System (TDGMS)

a. Summary. The TDGMS system operated all 16 sites in the Walla Walla District. Ten of the sites were operated year round and 6 seasonally. Completed sensor performance evaluations using the primary standards calculated and quantified absolute accuracy

capability and repeatability of the TDGMS instruments. A comprehensive QA/QC program for TDGMS was utilized.

Seasonal TDG monitoring was performed at Dworshak (DWQI) on the North Fork of the Clearwater River, at Peck (PEKI) and Lewiston water intake (LEWI) on the main stem Clearwater River, Lower Granite (LWG), Lower Granite tailwater (LGNW), Little Goose (LGS), Little Goose tailwater (LGSW), Lower Monumental (LMN), Lower Monumental tailwater (LMNW), Ice Harbor (IHR), Ice Harbor tailwater (IDSW) on the Snake River and at Pasco (PAQW), McNary forebay Oregon (MCQO), McNary forebay Washington (MCQW) and McNary tailwater (MCPW) on the Columbia River.

TDG station barometers were recalibrated to implement a temperature correction. New total dissolved gas-monitoring deployment systems were installed at Lower Monumental and Ice Harbor Tailwaters. These stations had a major change in design, which is currently being evaluated. Proposed activities for 2002 include implementing this new design for the repair of three other stations.

Other proposed activities for 2002 include altering the depth of the probe to negate thermal influence in the fore bay stations. Depth of instruments will also be closely monitored. More precise barometric pressure sensors will be procured for replacements and additional secondary standard equipment will replace equipment that is no longer serviceable. Programmed replacement of sondes will be implemented beginning with those instruments that have passed their operational service life but have not completed the Service Life Extension Program (SLEP). Future instrument retirement schedules will be programmed after this years QA/QC evaluation. The TDGMS Standard Operating Procedure (SOP) manuals should be produced along with improvements to the QA/QC program.

3.3.1. McNary Project and Reservoir

District personnel constructed and installed six multiple level thermister data buoys at McNary forebay. These catamaran pontoon mounted data collection systems measure temperature at various depths on an hourly basis. Data can be transferred from shore via radio modem. The data was utilized in 2001 to study the potential use of flow inducers to reduce thermal gradients.

Corps Fish Biologists placed battery operated temperature sensors that recorded readings hourly at fish passage facilities from April 1 through October 31; at the North ladder exit, entrance and first diffuser and at the South Ladder diffuser, junction pools 10 and 20 and at the collection channel between Units 8 and 9.
A terrestrial soil sampling was conducted on Corps property at Wallula Junction adjacent to McNary National Wildlife Refuge to evaluate use of material for shoreline restoration.

Proposed activities for 2002 include further improvements and additional of temperature monitoring equipment using the TDGMS backbone system. Implementation of RPA measures under the appropriate authority.

3.3.2. Ice Harbor Project and Reservoir

Corps fish biologists placed battery operated temperature sensors that recorded readings hourly at fish passage facilities from April 1 through October 31 at: the North Ladder exit pool, upper and bottom diffusers and upper and lower junction pools; at the South ladder exit pool, bottom diffuser, upper diffuser unit 6 and junction pool; Juvenile facilities at the North and South collection channels.
A new sonde deployment system was constructed at the tailwater TDG station. This system replaced the old cable and plastic pipe setup. It consists of a weighted pedestal anchor with a pulley and cable. The water quality sondes are attached to a canister connected to the pedestal cable, which is then retrieved by an electric drill operated pulley mounted on shore in a fiberglass NEMA box.

Proposed activities for 2002
Improve the temperature monitoring capabilities by installation of a few temperature sensors in the fore bay and fish ladders. Evaluate the feasibility of scroll case temperature monitoring improvements.

3.3.3. Lower Monumental Project and Reservoir

The new water quality sonde deployment system was also installed at the Lower Monumental Dam tailwater TDG station. Improve the temperature monitoring capabilities by installation of a few temperature sensors in the fore bay and fish ladders. Evaluate the feasibility of scroll case temperature monitoring improvements.

Corps Fish Biologist placed battery operated temperature sensors that recorded hourly readings at fish passage facilities from April 1 through October 31 at: the North Ladder exit pool, upper and lower diffusers, junction pool and collection channel; South Ladder exit pool, upper and lower diffuser, transition pool; Juvenile Facility collection channel, primary dewatering, raceway, separator and sample holding tank.

Proposed activities for 2002
Improve the temperature monitoring capabilities by installation of a few temperature sensors in the fore bay and fish ladders. Evaluate the feasibility of scroll case temperature monitoring improvements. Water velocity measurements using an ADCP could be measured at the sample locations.

3.3.4. Little Goose Project and Reservoir

Corps fish biologist placed battery operated temperature sensors that recorded hourly Readings at fish passage facilities from April 1 through October 31 at: the exit pool, 2 pools below diffuser 13, diffuser 1, junction pool and north shore entrance and at the Juvenile Facility primary dewatering structure, separator, raceway 10 and Sample Holding Tank.

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Both wells at Little Goose dam were tested before chlorination to determine coliform and fecal coliform bacteria counts. Both wells were tested for inorganic and volatile organic chemicals. Routine drinking water samples were taken monthly at service connections and tested according to state department of health guidelines.

Wastewater was tested monthly for suspended solids, 5 day BOD and fecal coliform bacteria. Wastewater system operational controls were analyzed and adjusted. All laboratory results and corps project test results were posted on the network drive. Major changes such as adjusting food to microorganism ratios resulted in significant improvements in effluent quality. Monthly discharge monitoring reports for forwarded to EPA.

Proposed activities for 2002

Draft letters have been compiled to update and apply for a new operating NPDES permit for wastewater effluent. Plans are to improve sampling efficiency of chlorinated wastewater effluent by utilizing a different sample location and new sampling equipment. Improve the temperature monitoring capabilities by installation of a few temperature sensors in the fore bay and fish ladders. Evaluate the feasibility of scroll case temperature monitoring improvements.

Reservoir sediment sampling is planned to characterize depth and composition of substrate. Water velocities may be measured at sample locations.

3.3.5. Lower Granite Project and Reservoir

Corps fish biologist placed battery operated temperature sensors that recorded hourly readings at fish passage facilities from April 1 through October 31 at: the exit pool, diffuser 14, below diffuser 14, between lower diffusers, the junction pool, north powerhouse channel, north shore collection channel; at the Juvenile facility separator, raceway 5, sample holding tank, collection channel by unit 1 and the collection channel by unit 6.

Both wells at Lower Granite dam were tested before chlorination to determine coliform and fecal coliform bacteria counts. Both wells were tested for inorganic and volatile organic chemicals. Routine drinking water samples were taken monthly at service connections and tested according to state department of health guidelines.

Wastewater was tested monthly for suspended solids, 5 day BOD and fecal coliform bacteria. Wastewater system operational controls were analyzed and adjusted. All laboratory results and corps project test results were posted on the network drive.

A large buildup of sludge was pumped out of the effluent tank and the tank was cleaned. This resulted in significant improvements in effluent quality. Pumping equipment was tested and recommendations made for system operations. A paper chart recorder was installed to verify pump lifts.

Proposed activities for 2002

Draft letters have been compiled to update and apply for a new operating NPDES permit for wastewater effluent. Evaluation of the ultra violet radiation system at Ilia Housing area will begin engineer testing and validation. Additional plans are to improve efficiency and equipment in the wastewater system. Multi level temperature thermister

buoys (mark II) will be installed at dam and forebay locations. Personnel will begin to compile and load sediment survey data into the SEDQUAL database.

3.3.6. Dworshak Project and Reservoir

No significant water supply or wastewater issues were reported this year. The thermister strings installed in the reservoir were pulled and the data is currently being evaluated. Additional temperature evaluation of Dworshak was identified as a significant requirement by the water quality steering group because of it mitigation potential.

Proposed activities for 2002

Water quality objective nine is devoted to Dworshak. At a minimum feasibility to accomplish this objective will be evaluated.

3.3.7. Mill Creek and Virgil B. Bennington Lake

In a letter from the department of Ecology dated 15 February 2002, Mill creek was CWA section 303(D) listed for temperature and pH. Consequently the tributary watersheds near this project were also listed for other parameters.

Proposed activities for 2002

Implement a monitoring program at Mill Creek for temperature and pH using existing district assets and evaluate the need for inclusion of this project in objective seven. Add a pH and temperature sensor to our existing gage on the Touchet River and take some coliform samples. Check existing authorities and Potentially Liable Party (PLP) status of the Touchet River before inclusion in objective seven. Do the same for the Walla Walla River and coordinate with Mr. Ronald White on his 1135 investigation of the Walla Walla River. Conduct no sampling or monitoring on the Walla Walla River until proper liabilities and authorities can be identified.

3.3.8. Lucky Peak Reservoir

No routine water quality activities were conducted at this project. The chief of hydrology section and the reservoir regulation team leader conducted several meetings and planning sessions with local authorities over water control issues. Most of the identified water quality problems associated with the Boise River occur downstream and independent of the project. Restoration and assistance services were not requested last year.

Proposed activities for 2002

The chiefs of H&H, hydrology, planning, and our marketing staff will continue to work with local officials and representatives. Water quality technical staff will continue to concentrate on the currently authorized water quality objectives. Future activities will be conducted on an as needed basis at this project.